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Naval Submarine Medical Research Laboratory

NSMRL Report 1144 5 October 1989

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MEDIC - CHEST PAIN

A Decision Support Program for the Management of Acute Chest Pain

USER'S MANUAL

by

LT Barclay G. Caras, MC, USNR, Karen D. Fisherkeller,
and LCDR David G. Southerland, MC, USN

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Released by:

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Commanding Officer
Naval Submarine Medical Research Laboratory

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NAVAL SUBMARINE MEDICAL RESEARCH LABORATORY

NSMRL REPORT NO. 1144

Naval Medical Research and Development Command
Research Work Unit 62233N - MM33C30.002-5004

Approved and Released by:

R. G. WALTER CAPT, MC, USN
Commanding Officer
NavSubMedRschLab

Approved for public release; distribution unlimited.

SUMMARY PAGE

THE PROBLEM:

To provide a user's manual for the Acute Chest Pain Diagnostic Program (CHEST) for the user unfamiliar with computers.

THE FINDINGS:

The manual contains introductory information, a description of equipment needed, an overview of the different parts of the system, a tutorial, a list of the treatment protocols, a list of definitions, and a sample data sheet.

APPLICATION:

This manual will enable a corpsman unfamiliar with computers to use the decision support program without the need for supplementary training.

ADMINISTRATIVE INFORMATION

This work was conducted under Naval Medical Research and Development Command Research Work Unit 62233N - MM33C30.002-5004. It was submitted for review on 28 August 1989, approved for publication on 5 October 1989, and has been designated as Naval Submarine Medical Research Laboratory Report No. 1144.

ABSTRACT

This user's manual is designed to accompany the MEDIC - CHEST PAIN Program for MS-DOS computers and replaces the previous manual (NSMRL Report #1110). The manual contains introductory information, a description of equipment needed, an overview of the different parts of the system, a tutorial, a list of the treatment protocols, a list of definitions, and a sample datasheet.

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APPENDIX A. TREATMENT PROTOCOLS

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1. INTRODUCTION

1.1 Historical Perspective

On board the submarine, you, the Independent Duty corpsman, are responsible for the diagnosis and treatment of patients who present with serious illness during the patrol. In most cases, patients can be managed safely aboard the submarine. However, for some life-threatening illnesses it is your responsibility to recommend evacuation of the patient to shore-based facilities. The decision to evacuate is potentially dangerous for the patient and costly in terms of the monetary expense of the evacuation and possible compromise of the submarine's mission. Your decision is complicated by limited laboratory facilities and by mission constraints which often prevent communication with shore-based facilities.

A computer based medical support system has been developed to assist the corpsman in the diagnosis and management of patients who present during the patrol. When completed, the system will consist of this program and programs for acute abdominal pain, dental complaints, ophthalmology, psychiatry, and trauma. Each program will provide you with diagnostic and treatment suggestions based on the signs and symptoms entered into the computer. The purpose of the system is to assist you in differentiating between cases that require MEDEVAC and those that may be managed aboard and to provide guidance for the treatment decisions made by you, the corpsman.

1.2 Theoretical Basis and Limitations of the Program

Unlike their human diagnostician counterparts, diagnostic computer programs cannot think. The conclusion reached by the computer is based on a statistical analysis. In fact, the computer's diagnosis is expressed as a percentage probability. The program, by analyzing the presenting signs and symptoms, predicts the relative likelihood of four different diagnoses based on a statistical analysis of records of real patients presenting for emergency care.

The program considers four diagnostic categories in the case of chest pain. This represents a specific subset of the diagnoses that the provider must consider when a patient presents with acute chest pain. The program will provide assistance in identifying the most common dangerous causes of acute chest pain.

You must rely on your clinical judgment and expertise both in deciding to use the program and in interpreting the results of the computer analysis. The program will tend to lump diagnoses into categories and lacks the ability to differentiate between diagnoses in a given category. Additionally, the computer cannot tell you that it "doesn't know" the answer. It will always make a diagnosis once a minimum number of responses have been entered. A wide experience of patient contacts went into the program's database, producing a diversity of presentations. However, just as some atypical

presentations confound human providers, they may limit the computer's certainty. The computer's "confidence" in a given diagnosis is expressed as a percentage - see above and Section 4.

The definitions of terms listed on the history and physical pages (and Appendix B) are intended for use in the context of the program. In some cases, they may differ from the traditional usage or your training. Additionally, some terms may seem to be included in an inappropriate category. This is due to the nature of the statistical analysis performed by the program and the way it weighs different findings in relation to one another. Do not use Appendix B in place of a medical dictionary or a physical examination text. HOWEVER, it is important that you and the computer are "speaking the same language," so familiarize yourself with the program's terminology.

1.3 Treatment Protocols

The Chest Pain Program treatment protocols were written, and subsequently revised, based on the most current treatment recommendations. In all cases, every effort was made to write protocols that are reasonably within the capabilities of the Independent Duty Corpsman. When applicable, they are consistent with Force Medical instruction and higher authority. A thorough review of current Authorized Medical Allowance Lists (AMAL) for submarines and surface ships was conducted to insure the availability of recommended medications. Completed protocols were reviewed and edited by a U.S. Navy Internist familiar with the limitations of medical care at sea and a civilian Cardiologist.

1.4 Purpose of the Manual

The purpose of this manual is to train you in the use of the computer based chest pain medical support program. Use of the chest pain program is predicated on training for duty as an independent corpsmen and mastery of the knowledge and skills required to take a history and conduct an examination for the indicants used by the program. The manual is written for the person with little or no prior experience with computers. After reading the manual, you should be able to use the program without the need for supplementary training.

The manual is divided into five sections. Section 1 describes the history and the theoretical basis of the computer based decision support system. Section 2 lists the hardware and software requirements, the disk contents, how to load and start the program, and important keys. Section 3 discusses the diagnostic categories, when to use the program, and the chest pain data sheet. Section 4 describes actual use of the medical support program, including a detailed description of each module: the diagnostic module, the training module, and the SF-600 generation module. The fifth section is a step by step tutorial, taking the user through a case from loading the program to reviewing the treatment protocol.

In addition, there are three appendices. Appendix A contains the treatment protocols and includes a discussion and differential diagnosis; Appendix B lists definitions of each term used on the datasheet; a reproduction of the chest pain data sheet is given in Appendix C. The text of Appendices A and B are also included in the program as the "DISPLAY TREATMENT" and the "HELP / ?" function, respectively. It is important to read through the entire manual and to be familiar with all aspects of the chest pain program before using it clinically.

2. GETTING STARTED

2.1 Equipment Needed

To use the Chest Pain Medical Support Program as supplied, you must have an IBM PC or IBM PC-compatible system with the characteristics outlined below.

2.1.1 The Computer

The computer should be "IBM-compatible," and the operating system must be MS-DOS version 2.0 or higher, or a comparable version of PC-DOS.

The Chest Pain Medical Support Program will not run on the Zenith-100 series microcomputers (Z-100 and Z-120) unless a special circuit board has been installed. Note that while the Z-100 series will not run the program, the Z-100 PC series computers will. As a general guide, Zenith computers with moveable or detachable keyboards are IBM compatible, while those which have the keyboard built in are not IBM compatible unless they have been modified.

2.1.2 Hard Drive

The program is designed to be installed onto a hard drive (fixed disk).

2.1.3 Graphics Capability

To run the program, the computer must have a color graphics adapter (CGA) or equivalent. (Note: Most enhanced graphics adapter (EGA) boards have a CGA mode.) A color monitor is not necessary.

2.1.4 Memory Requirements

Most IBM compatible microcomputers now come with at least 512 kilobytes of random access memory (RAM). This is more than enough memory to use the program.

2.1.5 The Printer

The use of a printer is optional. Cases can be entered and stored without it. However, a printer is useful for making hard (printed) copies of written information displayed and for utilizing the SF-600 capability of the program.

2.2 Disk Contents

You will be supplied with one copy of the chest pain medical support program. This is the original disk. After installing the program, store this disk in a safe place and do not use it unless your working copy of the program becomes damaged.

2.3 Installing the Chest Pain Program

Follow the steps listed below to install the program on your hard drive.

Insert the original disk into external drive A. Type "a:install" and press "ENTER". A number of prompts will appear on the screen, enter the information requested:

"Enter the letter of the hard drive on which the program is to be installed: (D)". This indicates that the default drive is D. If you want the program installed on the drive D hard drive, press "ENTER". If you wish to designate another drive,enter the appropriate letter and press "ENTER".

"Enter the name of the subdirectory." The subdirectory is the location on the hard disk where the program is stored. We suggest you use the name "CHEST", but you can name the subdirectory anything you want. Enter the name and press "ENTER" the subdirectory will automatically be created.

"Is the above information correct (Y/N)." Enter your response and press "ENTER". The program will now be installed onto the specified hard drive in the subdirectory you have named. "Installation complete" will be displayed.

2.4 Starting the Program from a Hard Drive

The program has been installed in such a way that typing "CHEST" from any directory or drive will start the program. Return to the DOS prompt (eg: C>) and type "CHEST" and press "ENTER".

2.5 Disk Backup

A backup is a separately stored copy of all of the data on a disk.

2.5.1 Why Make Backups

Backups ensure that your programs and data are always available to you. If a disk surface is damaged, the information on the damaged portion of the disk may be lost. This damage can occur as a result of poor disk quality, rough handling, disk age, heavy use, electrical "glitches" in the power supply, or other events that subject a disk to strong physical or electromagnetic forces.

2.5.2 How to Make a Backup

To make a backup, you must first format a floppy disk. Follow the steps in your computer and DOS manuals. Label the disk "Chest pain - real case data - backup" or with other appropriate label. Once you have information stored on the disk, do not format it again as doing so will erase the data you have stored.

Place the formatted disk in the external drive (probably drive A) and type the command "CHSTBKUP" at the DOS prompt. "Copy Complete" will be displayed when the backup is complete.

Make backups frequently enough to avoid losing large amounts of data should a disk fail.

2.6 Important Keys

To use the program effectively, you need to become familiar with several keys that are often used. The names of keys available for use are usually listed at the bottom of the display screen. The following is a short description of the use and possible locations for certain commonly used keys. If you cannot find the keys, consult your computer users manual for their location.

2.6.1 Question Mark Key

The question mark key, "?", is used to obtain help throughout the program. For example, pressing the question mark key while on one of the history or physical examination pages will give the definition for the sign or symptom highlighted by the cursor (highlighted bar).

2.6.2 Arrow Keys

The arrow keys are usually found on the numeric keypad at the right of the keyboard. To use these keys, you must first ensure that the numeric keypad lock key (NumLock) is set. The NumLock key toggles back and forth from using the keypad for the arrow and other special keys to using the keypad for entering numbers. Some computers do not have a numeric keypad. If this is the case, consult your computer user's manual for information on the locations and labels of special keys.

2.6.3 Return/Enter Key

This is actually one key. On some computers it is labeled as "Return" and on others as "Enter". It is usually a large key just to the right of the conventional typewriter keyboard. This key is used to tell the computer that you are through typing and that the computer is to take the information just typed and use it in the program.

2.6.4 Tab Key

The Tab key is normally found in the same position as on a typewriter. The Tab key has a special function in the data entry section of the chest pain diagnostic program. When the key is pressed, the cursor will jump to the first item of the next question. If the cursor is on the last question of the display page, pressing the tab key will move the cursor to the first question on the page.

2.6.5 Ctrl-Break Key

Ctrl-Break is accomplished by simultaneously pressing the Ctrl key and the Break key. The Ctrl-Break key is used to abort the running program. This is an inelegant way of exiting the program. After pressing the Ctrl-Break key, you will be asked if you want to terminate a batch job. Reply by pressing the "N" key. The screen will be blanked, and you will return to the MS-DOS prompt. The Ctrl-Break key should not be used routinely to exit the program.

2.6.6 Miscellaneous Keys

Several alphanumeric keys are also used as command keys. These are the letters "N", "P", and "X". These keys are used to move within a defined group of pages such as a treatment protocol.

The "P" key is used to take you to the previous page. If you are on the first page, you will be returned to the previous menu.

The "N" key is used to take you to the next page. If you are on the last page, you be returned to the previous menu.

The "X" key is used as an exit. It will return you to the previous menu.

3. GENERAL ASPECTS OF THE CHEST PAIN DECISION SUPPORT PROGRAM

3.1 Diagnostic Categories

The diagnostic program is not intended to specifically diagnose all causes of acute chest pain. Instead, the program can aid the corpsman in reliably diagnosing four illnesses which represent the most common and most serious causes of chest pain. These are: Myocardial Infarction (M.I.), Angina Pectoris (ANGINA), Chest Infection (CHINF), and Non-specific Chest Pain (NONSCP). Chest infection includes not only illnesses such as bronchitis and pneumonia, but also pneumothorax. Originally, it was intended that pneumothorax would be treated as a separate disease category, but its low incidence in the population necessitated including it with the chest infection category. Non-specific chest pain includes those entities which are more vague and generally amenable to symptomatic treatment.

Together, these categories encompass almost all of the causes of chest pain in the target population. The program cannot address cardio-pulmonary problems characterized primarily by indicants other than chest pain. A discussion of each diagnostic category is presented at the beginning of each treatment protocol in Appendix A.

3.2 When to Use the Chest Pain Diagnostic Program

The computer aids you by storing information on the presentation of hundreds of cases of chest pain. It rapidly sorts data and performs statistical analyses. However, the computer lacks the ability to think. It is the your responsibility to rely on your clinical judgment and expertise in deciding when to use the program and in making the final diagnosis.

The Chest Pain Diagnostic Program is intended for use with a population between the ages of 17 and 79 who are experiencing chest discomfort of less than 7 days in duration. In making a decision to use this program, you must remember that not all patients with cardiac illness report pain in the chest. Some experience only referred pain to the jaw or teeth; others experience a sensation of tightness and/or squeezing, heavy, pressing, crushing pain. You must also bear in mind that the program provides relative probabilities for only four disorders, M.I., ANGINA, CHINF, and NONSCP. Chest pain diseases other than these are not considered by the program. You must rely on your own expertise to decide when the program is appropriate to use.

You must rely on your own clinical judgment and expertise both in deciding to use the program and in interpreting the results of the computer's analysis.

3.3 Chest Pain Data Sheet

The chest pain data sheet provides you with a guide to use in performing the history and physical examination. It consists of 27 history categories and 20 physical exam categories. The history portion of the data sheet is shown in Figure 3-1. Findings on the history and physical exam categories are used by the computer program to arrive at a diagnosis. When a patient presents with chest pain, the corpsman should first conduct a history and physical exam and record his findings on the chest pain data sheet. Later, you enter the case into the computer, transferring the information recorded on the data sheet into the computer. A full size reproduction of the chest pain data sheet is provided in Appendix C.

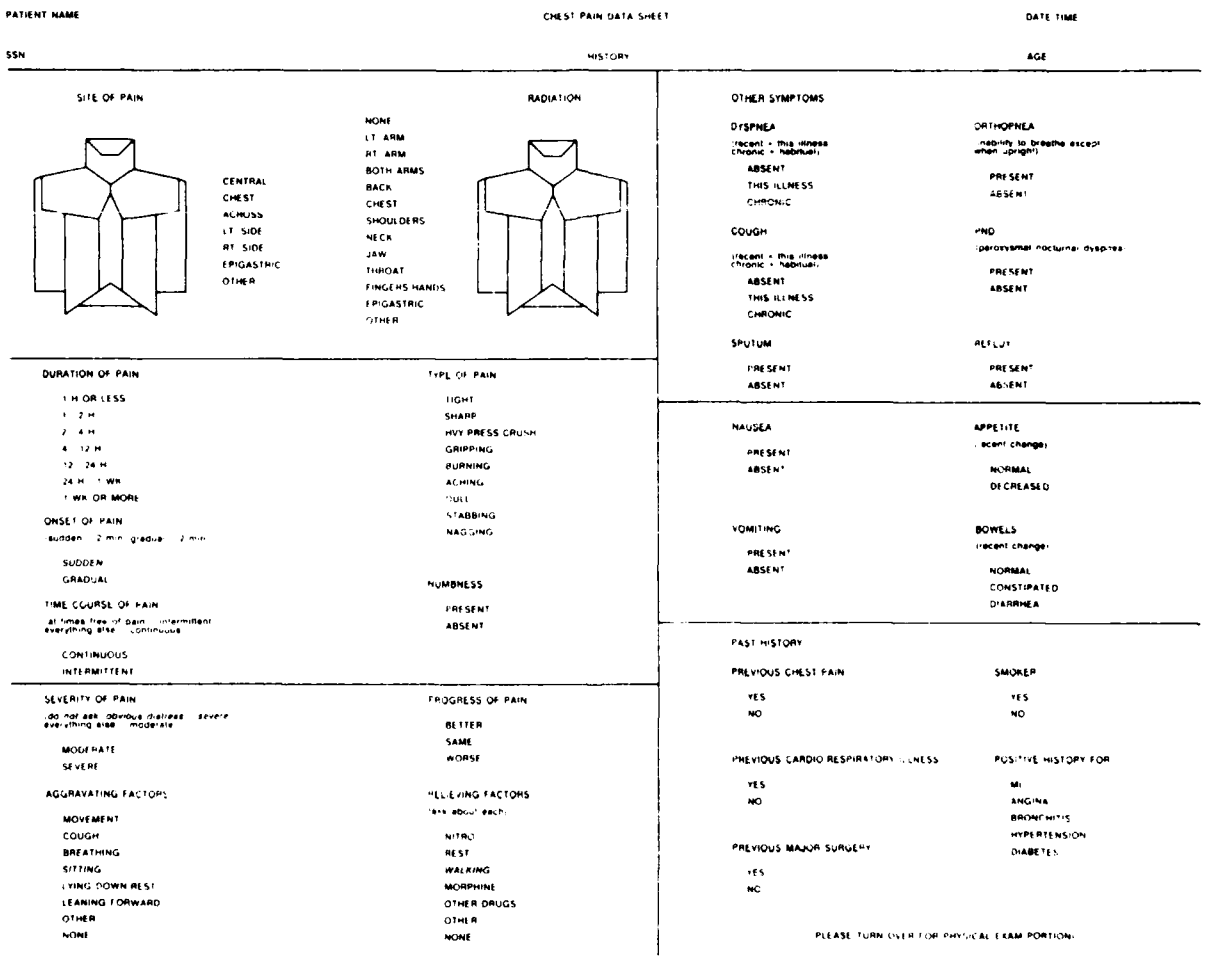

Figure 3-1 History Portion of the Chest Pain Data Sheet

3.4 Symptom Category Definitions

The accuracy of the diagnostic program is dependent on the accuracy of the data collected by you. You must adhere to standardized definitions and methods of data collection in completing the chest pain data sheet. All information that can be gathered must be evaluated and entered as specified in Appendix B. Definitions may also be accessed from within the diagnostic program.

The definitions listed in Appendix B are intended for use in the context of the program. In some cases, they may differ from the traditional usage or your training. Additionally, some terms may seem to be included in an inappropriate category. This is due to the nature of the statistical analysis performed by the program and the way it weighs different findings in relation to one another. Do not use this section in place of a medical dictionary or a physical examination text. HOWEVER, it is important that you and the computer are "speaking the same language," so familiarize yourself with this section.

4. CHEST PAIN PROGRAM MODULES

The chest pain decision support program is divided into three primary modules: the main diagnostic module, the training module, and the SF-600 generation module. Each of these modules will be discussed in order.

4.1 Overview of the Main Diagnostic Module

This module contains the diagnostic program for evaluation of real and simulated cases. To load the chest pain diagnostic program follow the directions given in Section 2.4 - Starting the Program.

4.1.1 Customization Page

The first time you run the program, you will be asked if you have a color monitor and to enter the name of your unit, the hull number, your name, and your SSN. This page will be displayed only if the information has not been previously entered. To continue to the next display page, follow the directions at the bottom of the display screen and press any key. Throughout the program, directions can usually be found at the bottom of the screen.

If the information displayed on the title page is incorrect, or you wish to change the name of the provider, exit the program and return to the MS-DOS screen. Type the following exactly as it appears between the quotes at the "A>" prompt: "**del ship.dat**" and press "ENTER". This will delete the previously entered information. When you restart the program, it will again ask you for the identifying information. If you wish to change the input on your monitor, enter "**del abdgraph.dat**" at the prompt.

4.1.2 The Title Page

Once the disk has been loaded and the "CHEST" command given (see Section 2.4), the title page will appear on the screen (Figure 4-1).

The Title Page contains the name of the diagnostic program and the address and phone number of the program developers. Please forward any problems or questions regarding the Chest Pain Diagnostic Program to:

Naval Submarine Medical Research Laboratory
Naval Submarine Base New London, Box 900
Groton, CT 06349-5900.

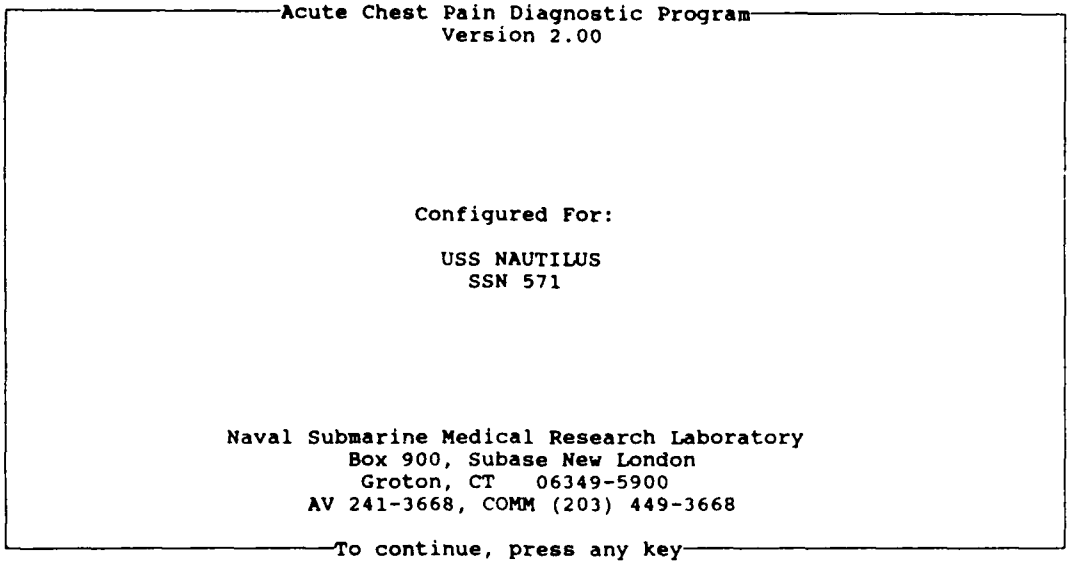

Figure 4-1 Title Page of the Chest Pain Diagnostic Program

Pressing any key takes the user to the disclaimer page.

4.1.3 The Disclaimer Page

This page is displayed after the title page. The disclaimer page is a very brief summary of the program including a statement which, once again, emphasizes that your judgment takes precedence over the computer's diagnosis when any doubt exists. Read this page before going on.

4.1.3.1 Privacy Act Statement

Some information stored automatically by the program is subject to the Privacy Act of 1974. Just as with a Health Record, you are bound to safeguard privileged patient information stored on disk from unauthorized or unnecessary disclosure.

4.1.4 The Main Options Page

The Main Options page provides a menu giving the user 9 program options (Figure 4-2).

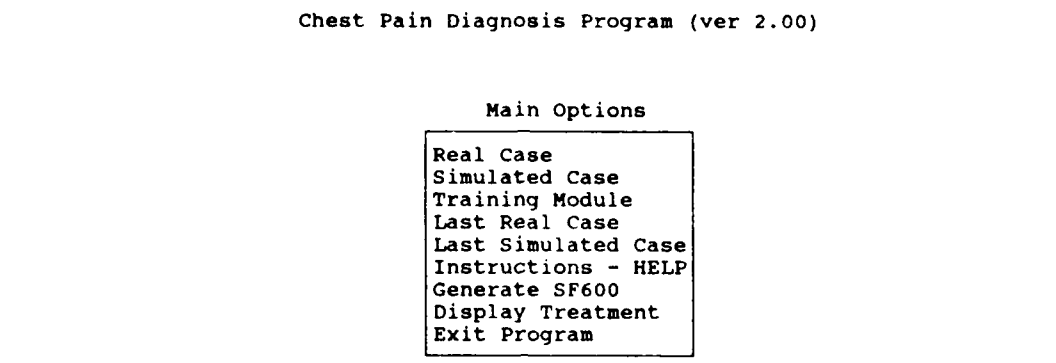

Figure 4-2 Main Options Page

4.1.4.1 Real Case

This option is selected when the user wants to enter the signs and symptoms and obtain a computer-based diagnosis for an actual patient. Real cases are stored on the disk in a way so that they can be printed in a narrative form on a SF-600.

4.1.4.2 Simulated Case

The simulated case option should only be used for training purposes. It allows you to 'make up' history and physical exam findings and see how changes in symptom entries affect the computer diagnosis. Both real and simulated cases entered into the computer are stored on the disk, but only real cases are stored in a way that allows SF-600 medical record entries to be printed.

4.1.4.3 Training Program

The training program presents patient narratives. Based on the narrative, you complete a data sheet, enter the findings, make a diagnosis, and compare your diagnosis to the computer derived diagnosis. Additionally, the findings you enter are compared to the computer's information on the case and scored for accuracy.

4.1.4.4 Last Real Case

Selection of this option will result in the retrieval of the last real case entered by you into the computer. This option will allow you to review the signs and symptoms for the last case. Also, if you are performing serial exams, you can update a copy of the last exam instead of having to re-enter the entire case each time. Be sure to update the date and time when performing serial exams (see Section 4.1.5.4). Real cases prior to the last real case cannot be retrieved except as part of the SF-600 generation module.

4.1.4.5 Last Simulated Case

This option retrieves the last simulated case entered by you into the computer. Simulated cases prior to the last simulated case cannot be retrieved by the user.

4.1.4.6 Instructions - HELP

The instructions consist of three pages of general background information on computer-assisted diagnosis of chest pain.

4.1.4.7 Generate SF-600

Select this option to run the SF-600 generation program. This program creates patient medical narratives based on the signs and symptoms entered for real cases. It is discussed in detail in section 4.3 - Overview of the SF-600 Generation Module.

4.1.4.8 Display Treatments

This option provides a menu of the treatment protocols for each of the four diagnostic categories. Select the category of interest and the treatment protocol will be displayed. The Display Treatments menu option is also available from the Diagnostic Summary Page.

4.1.4.9 Exit Program

Select this option to end your interaction with the computer. Use of the program should always end with selection of either this option or the End Interaction option on the Diagnostic Summary Page. Ending your interaction with the program in any other way risks both the loss of case data and damage to, or loss of, the program.

4.1.5 Data Entry Options Page (Real Case Example)

In order to enter a real case, use the arrow keys to move the cursor to the REAL CASE option and push the "ENTER" key. Once this option is selected, the computer requests the patient's sex, age, social security number, and confirmation of the date and time of the exam. If the corpsman enters an age which is outside the limits of the program (less than 17 or greater than 79), the program warns you and

asks you to re-enter the patient's age. If either the date or time is in error, you should make appropriate corrections.

Next, you proceed to the Data Entry Options Page (Figure 4-3). The options are: GO TO HISTORY PAGES, GO TO PHYSICAL EXAM PAGES, MAKE DIAGNOSIS, GO TO SSN/AGE/TIME PAGE.

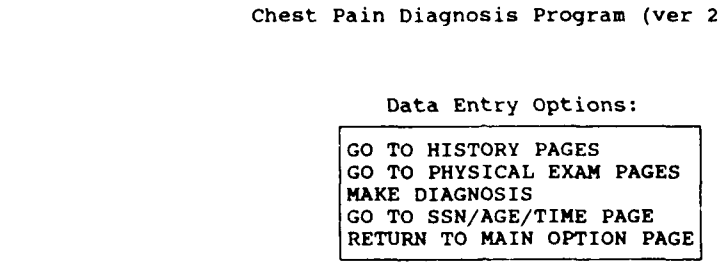

Figure 4-3 Data Entry Options Page

4.1.5.1 Go to History Pages

You select this option to proceed to the history section of the chest pain data sheet. There are 6 history pages which replicate the paper and pencil form of the chest pain data sheet. The second page of the history section is shown in Figure 4-4. In entering symptom data, follow the instructions in the following sections: Data Entry; Moving the Cursor; Proceeding to Next or Previous History Pages; Correcting Errors; and Definition of Symptom Categories.

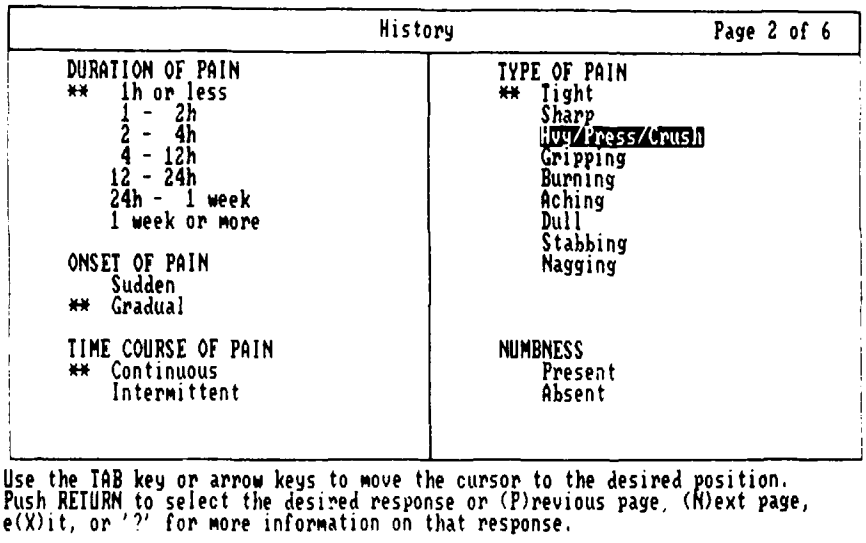

Figure 4-4 Data Sheet Page from the History Section

Data Entry: To enter history symptoms into the computer, move the highlighted bar (the CURSOR) to the desired response and press the "ENTER" key. Symptoms that have been entered into the computer are marked with a double asterisk. Data need not be entered sequentially. You can move back and forth between categories on one page or from page to page.

Moving the Cursor: The position of the cursor is controlled by the arrow keys (UP, DOWN, LEFT, RIGHT), by a corresponding letter key ((U)P, (D)OWN, (L)EFT, (R)IGHT), and by the "TAB" key. The arrow and letter keys move the cursor through each response in the specified direction. The "TAB" key moves the cursor to the initial response of the next category.

Proceeding to Next or Previous Pages: Press 'P' to return to the (P)revious page. Press 'N' to proceed to the (N)ext display page. Pressing 'P' or 'N' while on the first or last data sheet pages respectively will return the user to the previous menu.

Correcting Errors: Errors made in data entry can be corrected in one of two ways.

1. If the responses within a symptom category are mutually exclusive (only one answer is logically possible), move the cursor to the desired response and press the "ENTER" key. The symptom entered in error is removed and the desired response is starred.

2. Any symptom can be removed by placing the cursor on it and pressing "ENTER". The asterisk marking the response will vanish and the entry has been omitted. Use this method for categories where more than one response is possible.

Definition of Symptom Categories: Detailed definition of symptom categories can be obtained by placing the cursor on the symptom in question and pressing the '?' key. The definition of the symptom category will be displayed. An example is shown in Figure 4-5. Pressing any key from within the definition section will return the user to the data page.

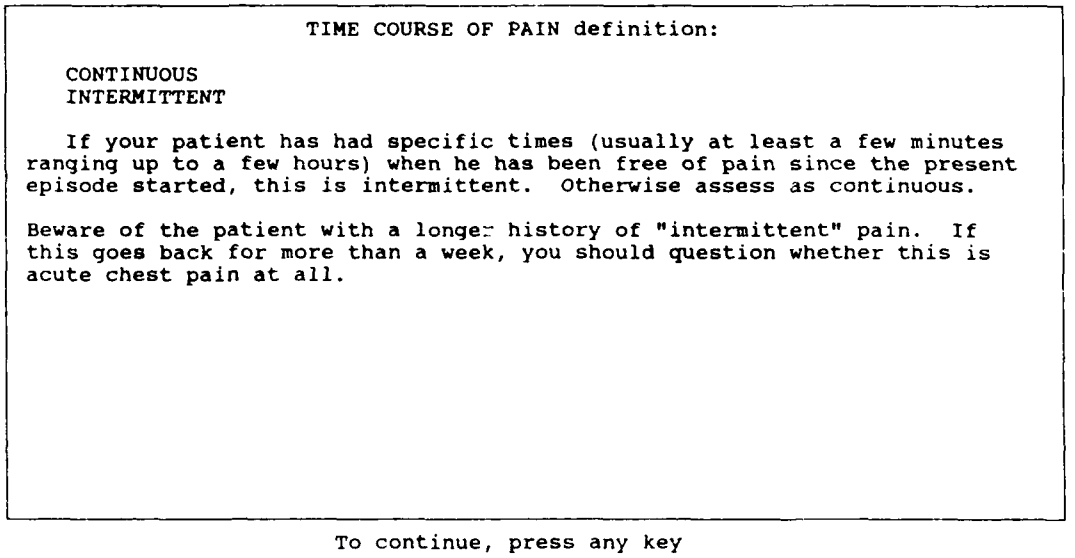

Figure 4-5 Symptom Category Definition for Time Course of Pain.

4.1.5.2 Go to Physical Exam Pages

You select this option on the Data Entry Option page to proceed to the physical exam section of the chest pain data sheet. There are 4 pages of physical exam findings that correspond to the physical exam portion of the data sheet. The first page of the physical exam section is shown in Figure 4-6. Follow the same rules outlined for entering the history data.

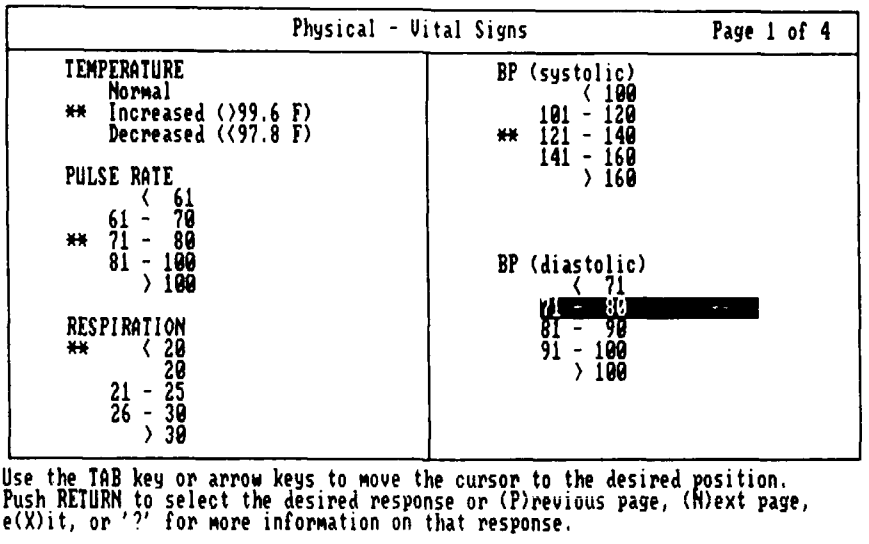

Figure 4-6 Data Sheet Page from the Physical Exam Section

4.1.5.3 Make a Diagnosis

You select this option to obtain a computer-generated diagnosis based on the symptom information entered into the computer. A minimum number of items must be completed for the program to work. If that number is not supplied, you are asked to enter more history and physical exam data. If the minimum number of items has been entered, the program proceeds to the Corpsman's Diagnosis Page (see Section 4.1.6).

4.1.5.4 Go to SSN/Age/Time Page

Select this option to change the age, sex, SSN of the patient, or update the date or time of the evaluation of the patient.

4.1.5.5 Return to Main Options Page

Choose this response to return to the Main Option Page.

4.1.6 Corpsman's Diagnosis Page

The Corpsman's Diagnosis Page (Figure 4-7) asks you to enter the chest pain diagnosis which you believe to be most likely. You are asked to enter your diagnosis whenever you enter a new case or make changes to a previous case.

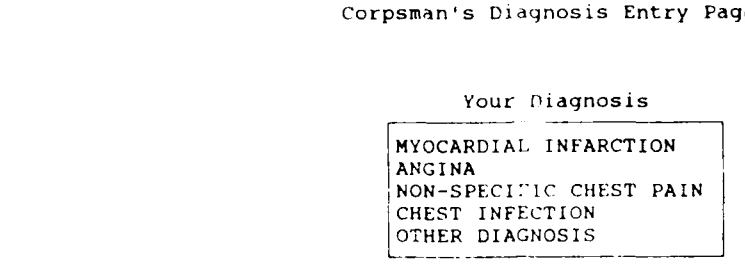

Figure 4-7 Corpsman's Diagnosis Page

The computer will compare the diagnosis provided by you to the computer derived diagnosis. The computer tells you whether or not it agrees with your diagnosis. If the computer and you are in agreement, the program proceeds to the Diagnostic Summary Page. If not, the computer displays key answers which support the computer diagnosis, and it asks you if you want to review or change any of your symptom entries. If you want to make changes, you enter 'Y' (for YES) and are returned to the previous menu where changes can be made to the history, physical exam or the SSN/Age/Time. If you don't want to review your entries or make any changes, then type 'N' (for NO) and continue on to the Diagnostic Summary Page. This procedure was put in the program to remind you again, that you alone are responsible for the diagnosis. Agreement between the symptoms and signs you record and your diagnosis is checked to warn you of any possible inconsistencies between your data and your conclusion.

4.1.7 Diagnostic Summary Page

Figure 4-8 is the Diagnostic Summary Page. The graph on the left shows the computed probability for each diagnostic category. The tallest bar corresponds to the most likely diagnosis. The program is "most sure" of the diagnosis when the probability is greater than 90% and "less certain" when the diagnosis is less than 90%. To help you keep this in mind, a line is drawn across the graph at the 90% level.

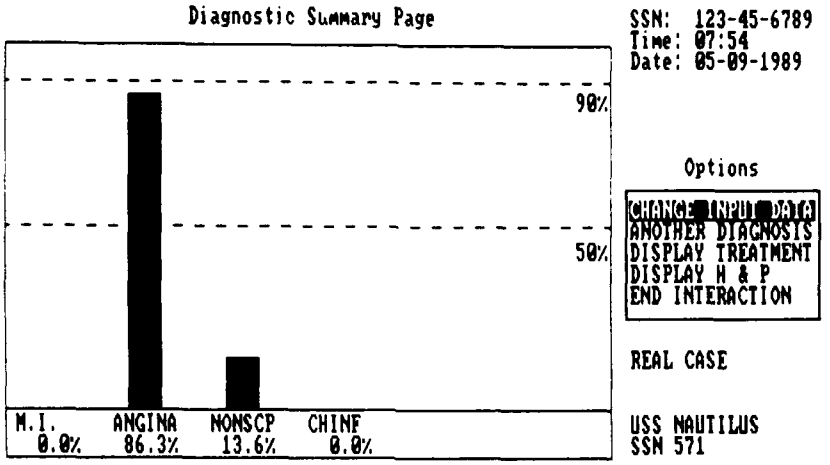

Figure 4-8 Diagnostic Summary Page

The date and time of the exam are listed in the upper right hand corner. If the case is real, the patient's SSN will also be listed there. The type of case, real or simulated, is shown in the lower right hand corner along with the name of the vessel.

On the right side of the diagnostic summary page are 5 options available to the corpsman. These are:

4.1.7.1 Change Input Data

Select this option to review or change any symptom entries relating to the present case. You can make changes to the history, physical exam, or SSN/Age/Time portions of the present case.

4.1.7.2 Another Diagnosis

Select this option to enter another case, either real or simulated. The case just entered will be saved, and the data display pages will be cleared. The program returns to the main option page described in section 4.1.4 (see Figure 4-2).

4.1.7.3 Display Treatment Protocols

Select this option to access a treatment protocol. Treatment protocols exist for each of the four chest pain diagnoses: Myocardial Infarction, Angina, Chest Infection, and Non-specific Chest Pain. Each treatment protocol consists of 5 sections: Discussion; Differential Diagnosis; Treatment; Usual Course with Treatment; and Complications and Their Management. The protocols are brief, practical, and take into consideration the medications available for use on board the submarine. They have been reviewed by hospital-based internists and Submarine Qualified medical officers. Other Navy approved references should be used to supplement these protocols when indicated.

Hard copies of the entire protocol, or any section of it, can be obtained by pressing the "PRINT SCREEN" (PRTSC) key when the desired section is displayed on the computer screen. Treatment protocols for the four diseases are included in Appendix B for easy reference.

4.1.7.4 Display H & P

Select this response to list on the screen the history and physical exam indicants for this case. A history summary is given on one page (Figure 4-9) and physical exam findings are given on another page. If a printer is connected to the computer, a hard copy of the indicant entries can be obtained (while they are displayed on the computer screen) by pressing the PRTSC key. After the symptom listing is completed, the program returns to the Diagnostic Summary Page.

```
History Summary (Real case)          SSN: 123-45-6789          13:13  05-08-1989

MALE                                  PND ABSENT
AGE 0-30                              REFLUX ABSENT
SITE OF PAIN RT. SIDE                 NAUSEA ABSENT
RADIATION NO                          VOMITING ABSENT
DURATION 1 W OR MORE                  APPETITE NORMAL
GRADUAL ONSET                         NORMAL BOWELS
INTERMITTENT PAIN                     PREVIOUS CHEST PAIN
TYPE OF PAIN SHARP                    NO PREV. CARD-RESP ILL.
NUMBNESS ABSENT                       NO PREV. MAJOR SURGERY
MODERATE PAIN                         NO HISTORY OF SMOKING
MOVEMENT AGGRAVATES
COUGH AGGRAVATES
BREATHING AGGRAVATES
PROGRESS BETTER
NOTHING RELIEVES
DYSPNEA ABSENT
COUGH ABSENT
SPUTUM ABSENT
ORTHOPNEA ABSENT

Enter (P)revious, (N)ext, e(X)it, or (?) for help.
```

Figure 4-9 Listing of History Symptoms

4.1.7.5 End Interaction

Select this option to exit the program and end your interaction with the computer. You will return to the operating system of the computer so that you may run other programs.

4.2 Overview of the Training Module

The training program presents patient narratives. Based on the narrative, you complete the paper and pencil form of the chest pain data sheet, enter the symptom findings into the computer, and arrive at a computer derived diagnosis. The program scores your accuracy in abstracting data from the patient narrative. No permanent record is maintained of your performance on the training program.

4.2.1 Case Narrative

You may choose from 50 case narratives. The cases do not change, so each case will always have the same narrative from session to session. This allows you to return to a specific case narrative at a later time. After selecting the number of the desired case, you will be shown a page of the history and another page of the physical findings. You may toggle back and forth from one to another. Enter the data from the narrative onto a chest pain data sheet. You may also elect to print the narrative using the "PRINT SCREEN" key and enter the data directly into the computer.

4.2.2 Enter Data

After completing the data sheet, choose this option to enter your findings. You will be taken to the Data Entry Options Page where you can enter history and physical exam data. After entering symptom findings and a diagnosis for the case, the Training Diagnostic Summary Page will be displayed. This page is identical to the Diagnostic Summary Page except in two regards. First, a score is displayed in the upper right quadrant. This score reflects the accuracy of the data entered for the case. It is based on both the number of items missed as well as the number of incorrect items. Second, missed and incorrect findings can be displayed by selecting the option "SHOW MISSED ITEMS" from the menu on this page. If too many items are missed on entering the case, the user will be notified and will not be able to go on to the Diagnostic Summary Page until some corrections are made.

4.2.3 Exit Training Program

This option exits the training module and returns the user to the Main Options Page.

4.3 Overview of the SF-600 Generation Module

The SF-600 generation module allows you to print the medical record entry for the patient whose data you entered into the program. The output of the program is in the form of a "S-O-A-P" note except that the letters "S", "O", "A", and "P" are not used. The date and time on the SF-600 will correspond to the date and time when the case was entered into the diagnostic module. The name and hull number of the vessel will be printed on the first line of the entry.

4.3.1 Output

The medical record entry can be sent to any one of three locations. It can be sent to the display screen, to a file where you can modify it with a word processing program, or directly to a printer. If you are sending the output to a printer, the computer assumes that the printer is using the actual SF-600 form, and so it will ask you if the printing is to begin on the front or back of the SF-600. You should always insert the form into the printer so that printing begins at the top of either the front or back page of the form. Otherwise, the computer will be unable to determine how many lines are to be printed on a particular side. Single spacing is used if the output is sent to the screen or to a file. If the output is sent to the printer, double spacing is used.

Be sure that you align the top edge of the page up with the top edge of the printer head, as you do with any printer form.

4.3.2 Selection of a Real Case

Only cases that have been saved as real cases can be used in the SF-600 Generation Module. A list of the real cases will be displayed by SSN, date, and time of exam. Use the arrow keys to move the cursor to the desired case and press the "ENTER" key to select it.

4.3.3 Modifying Vital Sign Values

Since the vital signs are entered into the program as ranges, you are given the option of entering actual values for these findings. If you would prefer to have the range printed, press the "ENTER" key by the appropriate item. If you do not want to have the item listed on the medical narrative, enter the letter "X" by the item.

4.3.4 Additional Information for Selected Items

You are given the opportunity to add to some of the categories in the history and physical examination sections. This allows for a more complete description of items for which "other" is offered as an alternative, e.g. site of pain, location of radiation, etc. You are also given the opportunity to comment on previous cardio-respiratory illness, previous major surgery, the location of decreased breath sounds, and abnormal heart sounds. As for Vital Signs, you may omit

the response (enter 'X'), or use the default response press "ENTER" given in the diagnostic module.

4.3.5 Additional Information for History or Physical Exam

You are given the opportunity to enter additional information for both the history and physical examination. You enter the information in a free text form at the end of the respective sections of the medical entry. The computer will prompt you at the appropriate times to enter this information if you so desire.

4.3.6 Final Diagnosis

Enter the final diagnosis to be recorded on the SF-600. Either type it in or choose to have the computer enter its diagnosis.

4.3.7 Treatment Plan

You have two options for entering the patient's treatment plan. You can enter it line by line, or you can use a plan which is already stored in a file on the disk. The second method allows you to store standardized plans for illnesses on the disk, and then access these plans for printing on the medical entry. To create and store standardized plans on the disk you will need to use a word processing program. Instructing you on this procedure is beyond the scope of this manual.

4.3.8 Changing the Printer Format

If the medical record entry is not reproduced correctly on your printer, you will probably need to modify the file SETUP.DAT (a DOS command typed verbatim at the "A>" prompt) where the printer parameters are kept. This is an ASCII file so you should be able to modify the parameters with any word processor or text editor that is available for your computer, such as the one included with MS-DOS. To make changes in the parameters, exit the Chest Pain Diagnostic Program by selecting the Exit Program option on the Main Option Page (4.1.4.8) or the End Interaction option on the Diagnostic Summary Page (4.1.7.5). Then, follow the instructions accompanying your word processor program or text editor to edit the file SETUP.DAT. A sample SETUP.DAT file is:

```
0
0
0
0
44
56
66
```

The first line (0) is the setting of the left margin of the front page of the SF-600. The second line (0) is the left margin of the back page. The third line (0) is the number of lines in the top margin of

the front page and the fourth line (0) is the same number for the back page. The fifth line (44) is the bottom margin of the front page and the sixth line (56) is the bottom margin of the back page. The last line (66) is the number of characters across the page.

You may need to experiment to determine which settings work best with your printer. Be sure to check the revision number on the SF-600 form. There are a number of different revisions available and the size of the form may vary.

5. CHEST PAIN DIAGNOSTIC PROGRAM TUTORIAL

5.1 Running a Real Case

In this section, we will "walk through" entering a real case into the computer. It is assumed that you have read the overview in the preceding chapters and that the program is installed on the hard drive. If not, do so now.

First you start the program. Type "CHEST" at the prompt and press "ENTER" to begin the program. If you have never used the program before, you should be asked several questions about your boat and your name. Your responses are necessary to print the SF-600. If you have used the program before, you will skip the customization page and will proceed to the Title Page, where your boat name should be displayed. If it is incorrect, follow the directions in the section on the customization page (4.1.1) to change it.

Follow the instructions shown on the screen, "press any key", until you reach the disclaimer page. Read this page before proceeding. Again, press any key to continue to the "MAIN OPTIONS:" page. The menu displayed here is the root menu for the program. All the modules of the Chest Pain Diagnostic Program are accessed from here. In our example, we want to enter a real case, so press "ENTER" to select the "REAL CASE" option, since it is already marked by the cursor. Use of the cursor control keys (arrow keys) will move the cursor to highlight the desired option, the "ENTER" key executes that option.

At the next screen you will be asked to enter the patient's sex, Social Security Number, and age. For our example, the patient's SSN is 123-45-6789, and his age is 23. After you have entered the above information, the computer will display a date and time for verification. The date and time should be the current date and time assuming they were entered correctly when the computer was first turned on. If either is incorrect, type in the date and time that the exam was conducted pressing "ENTER" after typing each. You will then be asked whether the information displayed is correct. If it is, type "Y"; if not, type "N" and repeat the above steps.

The "DATA ENTRY OPTION:" page is now displayed. From here you will make selections to enter the patient's history and physical exam findings. Also, you may return to the page where the patient's SSN, age, and time of exam were entered to make corrections.

The cursor is highlighting the "GO TO HISTORY PAGES" option, so press "ENTER" at this time. There are six history pages. Each page is numbered in the top right hand corner of the display. The layout of the questions is consistent with that of the data sheet. You can use the arrow keys and the "TAB" key to move the cursor in the appropriate direction within and between the symptom categories on each page. Use the down arrow to highlight "CENTRAL" and press "ENTER". A pair of

asterisks will appear by the selection and the central region of the chest will be filled in. Press "ENTER" again and note that the asterisks disappear, and the chest is cleared. Press "TAB" to move the cursor to the first response of each question on the page. Try it now. Type the "N" key (for "next page") to take you to page 2. Type the "P" key (for "previous page"). You should now be back on page one. Type "?" to see the definition of the question above the cursor.

Now that you have used the keys, answer every question on the history pages. You can make up answers for this example. When entering a real case, if you do not have a piece of information, leave it blank. For example, do not answer "ABSENT" if you do not know, as this would alter the diagnosis. When you have answered the questions on page six, type "N" and you will automatically return to the "DATA ENTRY OPTIONS:" page.

On the "DATA ENTRY OPTIONS:" page, press the down arrow once to move the cursor to the selection "GO TO PHYSICAL EXAM PAGES" and press "ENTER".

You are now on page one of the four physical examination pages. Using the same keys (arrows; TAB; N; P; ENTER) as before, answer all of the questions on each of the four pages and return to the "DATA ENTRY OPTIONS:" page by typing "N" when you have completed the last page.

Now that all questions have been answered, the computer can make its diagnosis. Press the down arrow twice to select "MAKE DIAGNOSIS" and then press "ENTER". The "CORPSMAN'S DIAGNOSIS" page will then be displayed.

Before the computer will display the computed diagnosis, you must first enter your diagnosis for the patient by selecting the appropriate response from those on the list shown on the display screen. After you enter your diagnosis, the computer will compare it with the computed diagnosis. If the two diagnoses are the same, the program moves to the "DIAGNOSTIC SUMMARY PAGE". If the two diagnoses disagree, the computer will give a list of items that play an important part in differentiating between the two diagnoses. You should review the list carefully to be sure that your entries were recorded properly. Pressing any key will take you to the "DIAGNOSTIC SUMMARY PAGE".

The "DIAGNOSTIC SUMMARY PAGE" will display a graphic representation of the probabilities for the various diseases considered by the program. Those probabilities above the 90% line are most likely. To the right of the screen is displayed the patient's SSN along with the date and the time of the examination. The statement "REAL CASE" and the ship's name and hull number will be listed in the lower right hand corner.

Press the down arrow three times to select the item "DISPLAY H & P" and then press "ENTER". You will be shown a summary listing of the history responses on one page and the physical examination responses on

the next page. You can obtain a hard copy of these two pages by pressing the "PRTSC" ("PRINT SCREEN") key. Return to the "DIAGNOSTIC SUMMARY PAGE" by typing "N" or "X" while on the "PHYSICAL SUMMARY" page.

Next, press the down arrow key twice to select the response "DISPLAY TREATMENT" and press "ENTER". The "TREATMENT SUMMARY" menu will be displayed. You may review the treatment for one of the diseases listed by using the arrow keys to move the cursor to the desired entry and pressing "ENTER". For our example, select "ANGINA". The first page of the treatment summary for angina will be displayed. Notice that the bottom right hand corner contains the current page number and the total number of pages in the summary. Each treatment protocol is comprised of a discussion, differential diagnosis, treatment plan with specific drug regimens as indicated, probable course with treatment, and possible complications and their management. Type "N" to move to the next page in the section, type "P" to move to the previous page, and "X" to exit from the section back to the "TREATMENT SUMMARY" menu. Type "X" at this time. Move the cursor to the last response entitled "EXIT THIS DISPLAY" and press "ENTER" to return to the "DIAGNOSTIC SUMMARY PAGE".

If you desire to make changes or update the history or physical, select "CHANGE INPUT DATA". The case is stored on the disk, and you will be returned to the "DATA ENTRY OPTIONS:" page where you can then modify your responses. Select "ANOTHER DIAGNOSIS" on the "DIAGNOSTIC SUMMARY PAGE" to store the current case on the disk, clear the responses made in the computer's memory, and return to the "MAIN OPTIONS:" page where you may either run the SF-600 generation program or enter data on a new patient. If you have finished with the program, select "END INTERACTION" to store the current case on the disk and return the computer to MS-DOS. Remove the floppy disk, if you have been using one, and turn off the computer.

5.2 Running a Simulated Case

To enter a simulated case, select the "SIMULATED CASE" option on the "Main options:" page. This option allows you to enter your own 'made up' history and physical exam findings into the computer. Simulated cases which are entered into the computer are stored on the computer disk, but only the last one is accessible by the user. They cannot be printed out on a SF-600. Since you use this option for self-guided instruction, you should complete a data sheet with a particular disorder in mind before you use the computer.

Once the simulated case option is selected, the computer requests the patient's sex, age, and confirmation of date and time of the exam. With a simulated case, the program does not request a social security number, but, instead, assigns the number 000-00-0000. Instructions for data entry and making a diagnosis are the same for simulated and real cases. Enter a simulated case as you would a real one (see section 5.1). The "DIAGNOSTIC SUMMARY PAGE" for simulated and real cases

differ only in that the phrase "SIMULATED CASE" is displayed instead of "REAL CASE" in the lower right hand corner.

5.3 Using the Training Module

The training program presents fifty case histories.

To run the Training Module, select "TRAINING MODULE" from the "MAIN OPTIONS:" menu. You will now be shown the "TRAINING OPTIONS" menu. Select the "READ CASE NARRATIVE" option. Enter "1" to select case number 1. You will then be shown the history narrative for case 1. After reading the narrative, fill out the chest pain data sheet and proceed to the physical page by typing "N". Read the physical narrative and fill out the remainder of the data sheet. Now type "N" to return to the "TRAINING OPTIONS" menu and select "ENTER DATA". Type "Y" to confirm that the case you are entering is case number 1. Now enter the patient's age. Notice that an SSN, date, and time for the exam are automatically supplied. You will then be taken to the "DATA ENTRY OPTIONS:" menu for the training module. From here, enter the information from the data sheet as you would for a real or simulated case.

When you have answered all the history and physical questions, select "MAKE DIAGNOSIS" from the training module "DATA ENTRY OPTIONS:" menu. If your responses differ greatly from those for that training case, you will not be able to proceed to the "DIAGNOSTIC SUMMARY PAGE." Instead, you will be told that you missed too many responses and asked to confirm the case number. In that instance, review the narrative, change your responses when they differ from the narrative, and select "MAKE DIAGNOSIS" again. As with a real or a simulated case, you must enter your diagnosis before the computer will display its own. When the "DIAGNOSTIC SUMMARY PAGE" is displayed, your score, the phrase "TRAINING CASE," the case number, and a new menu option, "SHOW MISSED ITEMS," are added to the usual summary data.

Your score is derived from the number of responses you entered correctly from the narrative divided by the total number of correct responses. Your diagnosis is not considered in deriving the score. Now select "SHOW MISSED ITEMS." This option allows you to view those responses you missed. Those correct responses you failed to enter are listed with the word "(omitted)" written alongside. Those you entered incorrectly are listed without comment. After viewing the items missed, press any key to return to the "DIAGNOSTIC SUMMARY PAGE."

You may select "END INTERACTION" to exit the program entirely, or you may select "ANOTHER CASE" to return to the "TRAINING OPTIONS" menu where you may select "EXIT TRAINING MODULE" to return to the "MAIN OPTIONS:" page of the diagnostic program.

5.4 Retrieving Last Real or Last Simulated Case

Select this option from the "MAIN OPTIONS:" page to retrieve the last real or last simulated case entered into the computer. While all real and simulated cases entered into the computer are stored on the disk, only the last ones are available for recall into memory.

Occasionally you will see a patient who presents with such a vague early picture that you must perform several evaluations until you are sure of your diagnosis. If you select the option "LAST REAL CASE," you can update the time and findings of the exam instead of re-entering all of the information each time you examine the patient.

If you do not make any changes to the recalled case, when you select "MAKE DIAGNOSIS," you will not be asked to enter your diagnosis. Instead, the program will proceed directly to the "DIAGNOSTIC SUMMARY PAGE:". If you make any changes, you will be asked for your diagnosis, and the case will be stored.

5.5 Using the SF-600 Generation Module

This module allows you to print the medical record entry of a real case on the SF-600. To use the module, select "GENERATE SF-600" from the "MAIN OPTIONS:" page. Assuming you have real cases stored, you will be shown a list of all of the real cases by SSN, date, and time. Use the arrow keys to move the cursor to the desired case and press "ENTER". Then you will be asked where the output of the generation module is to go. You can have the output displayed on the screen, printed on the SF-600, or sent to a file where you can make changes to it with a word processor file before printing the SF-600.

After you have made your selection, you will be shown the vital signs and lab values. Since the computer uses a range for each response for the vital signs and lab values, you will be offered a chance to change the response to a single value. If you do not know the single value, then you can press "ENTER" and the range will be printed on the SF-600, or you can type "X" and the item will not be mentioned on the SF-600. After answering all of the questions for the vital signs and lab, you will be asked to confirm that the responses are correct by typing "Y". Next you will be offered a chance to comment on specific items to which you responded positively. For example if the patient has had previous abdominal surgery, you will be asked to describe that surgery. Otherwise, you can enter "X" to omit any reference to the question, or just press "ENTER" to have the SF-600 state that the patient has a history of previous abdominal surgery. This same format is used for all of the other responses that may require comment.

If a rectal exam was performed, you will be asked if the stool was checked for occult blood and, if so, was it positive. This information is entered as "Y" or "N".

After you have replied to all of the specific responses displayed, you will be asked to enter any additional information on the history and then the physical examination that you feel is important.

After completing the history and physical questions, you will be asked if you desire to change the computer's diagnosis. If you do not agree with the diagnosis, type "Y" and you will be asked to enter the diagnosis as it should be printed on the SF-600. If you agree with the diagnosis, type "N".

Finally, the treatment plan is entered. You will be asked if you have a plan stored on the disk. If you have a plan stored as a file, type "Y" and enter the name of the file. You can make your own routine plans using a text editor program such as EDLIN or your favorite word processor. See the file VIRALGI.PLN for an example. If you do not have a plan stored, type "N". The number 1 will appear on the screen. Now enter the plan on the computer screen as you would prepare it using a typewriter. Each item in the plan is numbered, and can be several lines in length. If you need more than one line for the first item, press "ENTER" at the end of each line. This will give you a fresh unnumbered line to continue the item. However, the computer will print everything in the right place on each line of form SF-600. After you have entered all of the information for the first item and wish to go on to another numbered line, press "ENTER" on a line prior to entering any text. This signifies the end of the first item, and the number 2 will be displayed on a fresh line. Enter the information for the second item and proceed as above. When you have made all entries for the plan, press "ENTER" by itself while on one of the numbered lines with no text. This informs the computer that the plan is completed.

The computer will send the output to the location you specified earlier. If it is sent to the screen, the computer will print the information to the screen one page at a time, and you will be asked to press a key to continue to the next screen.

If the output is sent to the printer, you will be asked whether you are starting the printout on the front or the back of the SF-600. You must start at the top of the page on either side, otherwise the computer will not know how many lines it can print on the SF-600. Align the top edge of the SF-600 page (front or back) with the top edge of the printing head. If the medical record entry is sent to the printer, the computer will double-space the document. If the entry is sent to a file or to the screen, the computer will use single-spacing.

ACKNOWLEDGMENTS

The Chest Pain Diagnostic database was produced by Dr. F. T. deDombal at the University of Leeds, England.

The following people have been involved with the early development of the Chest Pain Diagnostic System for the Tektronix 4051: G. Moeller, B. Ryack, D. C. Arthur, R. Post, S. F. Osborne, and M. DeCora. Without their efforts, the program would not exist. The present revision has been completely rewritten for use with an MS-DOS microcomputer, and the treatment protocols have been updated.

The authors would like to express their deepest appreciation for the advice and constructive criticism of Dr. George Moeller, Dr. Bernard Ryack, Mr. Mark Fisherkeller, M.D., Mr. Ernest Noddin, Dr. Kendall Bryant, HMC(SS) Dan Johansen, HMC(SS) Dale Hamilton, CAPT Douglas Stetson, and HM1 Patrick Flaherty. In addition, Ms. Ellen Perkins and Mr. Harry Fiske provided superb technical support.

APPENDIX A
TREATMENT PROTOCOLS

MYOCARDIAL INFARCTION

1. **TREATMENT PROTOCOL AT A GLANCE** (see detailed discussion of treatment below; this section is for quick reference)

Remember the "A-B-C's" of Basic Life Support.

Notify command of need for MEDEVAC

Start IV with D5W at KVO to maintain IV access

Place at bed rest

Start O_2 2-4 litre/min by nasal canula

The goals of treatment of M.I. are to:

a. relieve the pain;
b. control dysrhythmias;
c. minimize infarct extension; and
d. compensate for compromised cardiac function.

a. Relief of pain:

Morphine sulfate 1-4 mg IV every 2-5 minutes as needed maximum of 10-15 mg in every 3 hours

Overdosage may cause CNS depression and hypotension.

Review use of naloxone (Narcan) and have supply ready.

Nitroglycerine will probably not offer relief in M.I.

b. Control of ventricular dysrhythmias:

Lidocaine:

1) For documented PVC's, V-tach or V-fib:

a) Bolus 75-100 mg (or 1mg/kg body weight) IV over 2 min.

b) Start 2 mg/min drip. May be increased to 4mg/min if PVC's continue. Diagnosis of continued PVC's may be by EKG or irregular pulse on exam.

c) Re-bolus with 50 mg (or 0.5 mg/kg) over 2 min at 8-10 min intervals to a maximum dose of 225 mg (boluses equal 75+50+50+50=225 mg).

d) Continue drip for 24 hours after dysrhythmia resolves.

2) For prophylaxis:

a) Bolus 75 mg IV over 2 min at time zero.

b) Start 2 mg/min drip.

c) May administer another bolus of 50 mg IV over 2 min at time 10 min.

d) Drip should be continued for 24 hours then halved (ie: to 1-2 mg/min) and discontinued after a total of 48 hours if the patient is stable.

c. The extent of the infarct is limited by:

bed rest, pain control, O_2.

Valium 5 mg PO bid-qid for control of anxiety.

d. For heart failure:

Furosemide (Lasix)

a) minimal rales Lasix 20 mg IV push

b) moderate rales (halfway up the back) Lasix 40 mg IV push

c) pulmonary edema (pinkish froth from mouth and rales throughout lung fields) Lasix 40 mg IV push (consider rotating extremity tourniquets, if you have training in this technique).

If no response to Lasix is noted after 45 minutes repeat Lasix 80 mg IV push (dose doubled).

Monitor input and outputs carefully.

2. DISCUSSION

Myocardial Infarction (M.I.) is a leading cause of mortality and morbidity in the population of developed, western civilization. In the

United States, the annual incidence is approximately 1,000,000 cases weighted towards a middle aged or older group. Pre-hospital mortality approaches 50%. M.I. is acute necrosis of myocardium secondary to a sudden interruption or decrease of blood supply. Major risk factors are hypertension, hyperlipidemia, and smoking. Diabetes and angina are related risk factors unlikely to be present in the submarine population.

A history of acute onset of crushing substernal chest discomfort radiating to the left arm and accompanied by diaphoresis, nausea, and a sense of impending doom is classic. The pain lasts longer than 20 minutes and, unlike angina, is unrelieved by nitroglycerin. Physical exam ranges from near-normal to cardiac arrest. An electrocardiogram (ECG) taken early in the course is abnormal less than 50% of the time, but may show ST elevation, T wave inversion, or evidence of left ventricular hypertrophy. Q waves appear later. Variations in the presentation are legion and well-documented. Diagnosis must be made on clinical grounds incorporating risk factors, the history and physical exam, the ECG (if available), and the practitioner's impression of the patient's overall condition. Early mortality is most feared and is due to lethal dysrhythmias. After 24 hours, the death rate declines steadily.

3. DIFFERENTIAL DIAGNOSIS

Many conditions may mimic symptoms of myocardial infarction. The differential diagnosis theoretically includes all causes of chest pain. A partial list is provided below. Other conditions that must be considered are discussed in other sections of these protocols.

a) pulmonary embolus
b) pericarditis
c) aortic dissection
d) acute pancreatitis
e) spontaneous mediastinal emphysema
f) angina pectoris
g) septic ulcer disease
h) cholecystitis
i) idiopathic

a) Pulmonary embolus is heralded by an acute onset of dyspnea, pleuritic chest pain, apprehension, cough, and, occasionally, hemoptysis. Substernal chest pain is present in less than 5% of the cases. Upon exam, tachypnea, tachycardia, diaphoresis, and rales may be noted.

Differentiation from M.I. may be difficult, but the dyspnea and tachypnea are prominent, whereas in M.I. pain is the chief complaint. If thrombophlebitis is noted, pulmonary embolism is more likely. The ECG will be normal or show tachycardia with or without T wave changes. Treatment includes bed rest, oxygen, leg elevation, pain medication,

and anticoagulation. Since anticoagulation therapy cannot be accomplished safely aboard ship, a MEDEVAC should be arranged.

b) Pericarditis is characterized by mild to severe precordial chest pain, leukocytosis, a pericardial rub, and, in some cases, fever. The pain may be relieved by sitting up and leaning forward. High dose aspirin and bed rest are therapeutic. Occasionally, leukocytosis is absent or minimal; fever is often absent. Pericarditis can be caused by infection, trauma, or neoplasm, or can be of unknown cause (idiopathic pericarditis).

c) Aortic dissection is a surgical emergency characterized by the acute onset of severe substernal chest pain radiating to the back. The patient may present in extremis. A diastolic heart murmur and significantly different upper extremity blood pressure readings may be noted. Treatment consists of bed rest with IV fluids, pain medication, and immediate MEDEVAC. Blood pressure should be maintained with saline or Ringer's lactate through two large bore IV catheters. Be prepared for large volume fluid resuscitation.

d) Acute pancreatitis is characterized by moderate to severe epigastric pain radiating to the back. It is often associated with alcoholism, trauma, cholecystitis, or ulcer disease and may occasionally be confused with M.I. The abdominal exam will reveal epigastric tenderness not found with M.I. The ECG may be normal or show sinus tachycardia. Treatment consists of bowel rest, IV fluids, parenteral pain medication, and, in some cases, antibiotics.

e) Spontaneous mediastinal emphysema is unlikely to occur except in divers or as a result of trauma. The presentation involves precordial chest pain with or without a pleuritic component in an otherwise healthy individual. Subcutaneous emphysema may be palpable as crepitus at the base of the neck and a voice change with hoarseness may be noted. A mediastinal crunch may be noted upon auscultation. The ECG is normal. Treatment with oxygen, an analgesic, and reassurance is usually adequate.

f) Angina pectoris - see ANGINA.

g) Peptic ulcer disease - see Non-specific chest pain (NONSCP)

h) Cholecystitis - see Non-specific chest pain (NONSCP)

i) Idiopathic chest pain is a diagnosis of exclusion. Even if the pain has no initially apparent cause, never assume it to be idiopathic until all other potentially dangerous etiologies have been ruled out.

4. TREATMENT OF MYOCARDIAL INFARCTION

The goals of treatment of M.I. are to:

a) relieve the pain;
b) control dysrhythmias;
c) minimize infarct extension; and
d) compensate for compromised cardiac function.

Remember the "A-B-C's" of Basic Life Support. The specific treatments below are of no value if a pulseless patient is not receiving CPR.

Arrange immediately to MEDEVAC the patient. The treatments outlined are intended to stabilize the patient while awaiting evacuation. However, MEDEVAC's are not always immediately available or operationally feasible. Always remain prepared to care for the patient for a prolonged period of time. The treatments as outlined are written for this contingency.

The patient should be placed in bed and an IV of D5W at KVO rate started. Do not fluid overload the patient; use fluids judiciously for the specific indications discussed below.

a) Relief of pain is accomplished with bed rest and IV morphine sulfate 1-4 mg every 2-5 minutes as needed for pain relief up to a maximum of 10-15 mg in every 3 hour period. Dosages above this amount are rarely necessary and may be associated with CNS depression and hypotension. Morphine should probably be withheld if the systolic blood pressure is below 100 mm Hg. While there is no harm in trying sublingual nitroglycerin (NTG) initially, classically the pain of M.I. is unrelieved by NTG. If full relief is obtained with NTG, angina is a more likely diagnosis. Other narcotics (e.g. Demerol) also relieve the pain of M.I., but are not discussed here.

> CAUTION: Whenever IV narcotics are used, the opiate antagonist naloxone (Narcan), should be immediately available. If the patient becomes unconscious while injecting morphine, 1-2 ampules (0.4-0.8 mg) of naloxone should be given IV and the A-B-C's of resuscitation employed as necessary. If the episode is due to narcotic overdose, consciousness will return within a minute or two. The pain will likely return and can be treated with morphine. The 10-15 mg morphine maximum dose every 3 hours may then have to be judiciously overstepped. The duration of action of naloxone is less than of morphine. Patients treated with naloxone for opiate overdose must be monitored for 3 or more hours.

b) Control of ventricular dysrhythmias is accomplished through adequate dosage of lidocaine. While in the past lidocaine was used only at the onset of a ventricular dysrhythmia, the current weight of evidence points toward its use in the prophylaxis of dysrhythmia as

well. Even if you are unable to monitor for dysrhythmias the protocol outlined below should be utilized for prophylaxis:

1) For documented PVC's, V-tach or V-fib:

   a) Bolus 75-100 mg (or 1mg/kg body weight) IV over 2 min.

   b) Start 2 mg/min drip. May be increased to 4 mg/min if PVC's continue. Diagnosis of continued PVC's may be by EKG or irregular pulse on exam.

   c) Re-bolus with 50 mg (or 0.5 mg/kg) over 2 min at 8-10 min intervals to a maximum dose of 225 mg (boluses equal 75+50+50+50=225 mg).

   d) Continue drip for 24 hours after dysrhythmia resolves.

2) For prophylaxis:

   a) Bolus 75 mg IV over 2 min at time zero.

   b) Start 2 mg/min drip.

   c) May administer another bolus of 50 mg IV over 2 min at time 10 min.

   d) Drip should be continued for 24 hours then halved (ie: to 1-2 mg/min) and discontinued after a total of 48 hours if the patient is stable.

c) The extent of the infarct is limited by bed rest, control of pain, and by the use of supplemental oxygen. The latter can be supplied at 2-4 liters/min by nasal cannula. Straining to have a bowel movement should be avoided. A Surfak capsule po bid is used. Valium 5 mg po bid-qid should be used for control of anxiety in the awake, alert patient.

d) Loss of myocardial tissue leads to varying degrees of impairment of myocardial function (pump failure). If rales are not heard upon chest exam and peripheral edema is absent, the impairment is (at least temporarily) adequately compensated.

5. **USUAL COURSE WITH TREATMENT**

Response to the therapeutic regimen will generally be good. Recurrence of pain with declining morphine blood level is common and treated with morphine IV. Transient ventricular dysrhythmia may occur, but is less common when lidocaine prophylaxis is given. Resolution of pain over the first 12-48 hours is accompanied by an increasing appetite, desire to ambulate, and denial by the patient of the seriousness of his condition. The initial "ice-chip" diet can be advanced from clear liquids to a regular diet over 1-2 days as seems

appropriate. Ambulation may begin on day 2 (minimal) and gradually advance to out-of-bed ad lib by day 7. Ladders should probably not be climbed until day 7, and then sparingly. Lidocaine, morphine, and the IV may be discontinued at 48 hours. Three weeks of no duty is reasonable, with a gradual return to light duty. NTG should be available for post-infarction angina. Transportation to a medical facility should be accomplished as soon as feasible.

NOTE: a) The use of subcutaneous heparin until fully ambulatory is controversial. Heparin 5000 units subcutaneously q12h is generally safe and minimizes the chance of deep venous thrombosis.

b) It is advisable to draw a blood sample (10cc red top tube) daily for 5 days, spin it down, and freeze the serum for possible enzyme analysis upon return. The analysis is possible even months after the event.

c) An ECG should be taken daily for 5 days. A previously non-diagnostic strip may later show an infarction or become normal, clarifying the initial impressions.

6. COMPLICATIONS AND THEIR MANAGEMENT

Uncontrolled dysrhythmias and cardiogenic shock are the principal complications of concern.

PVC's (more than 5 per minute) and V-tach (3 or more successive beats) denote ventricular irritability which must be treated to minimize the chance of ventricular fibrillation or degenerating cardiac output. Lidocaine should be used as described above in section 3-b. The cardiac compromise due to M.I. may be manifested by minimal rales and dyspnea or massive pulmonary edema with shock. Lasix is the diuretic most commonly used ashore for pulmonary congestion, but it is not on the AMAL. Your Squadron Medical Officer should decide whether you should carry Lasix aboard for use as outlined below. Fluid administration should be minimized if the physical exam demonstrates congestive heart failure.

For congestive heart failure, sit patient up and administer O_2 by face mask at 5 liter/min, and if:

a) minimal rales - Lasix 20 mg IV push.

b) moderate rales (halfway up the back) - Lasix 40 mg IV push.

c) pulmonary edema (pinkish froth from mouth and rales throughout lung fields) - Lasix 40 mg IV push (consider rotating extremity tourniquets if you have training in this technique). If no response to Lasix is noted after 45 minutes, repeat Lasix 80 mg IV push (dose doubled).

The input and outputs should be monitored with a urinary catheter

(indwelling type preferable). If Lasix is unavailable, morphine works well, with or without rotating tourniquets. For example:

a) minimal rales - morphine 5 mg IV over 1-5 min.

b) moderate rales - morphine 5-10 mg IV over 1-5 min.

c) pulmonary edema - morphine 10 mg IV over 1-5 min, consider rotating tourniquets.

There may be a fine balance between unacceptable levels of hypotension caused by morphine, Lasix, or head elevation and pulmonary edema from cardiac failure.

Patients presenting with pulmonary edema and hypotension should be treated with O_2, rotating tourniquets, and Lasix 40 mg IV push. The upright posture is contraindicated if the patient is unconscious, otherwise a 30 degree sitting angle is reasonable. Morphine will exacerbate the hypotension but may be tried if Lasix is unavailable. Fluids to correct the hypotension may worsen the pulmonary edema, but they have been tried (100-300 cc Saline over 15-30 minutes). Needless to say, these individuals are gravely ill and have an in-hospital mortality of 80%. Aminophylline 5mg/kg (i.e. about 350 mg) in minimal dilutent (D5W) given over 15 min may help. Aminophylline is not on the AMAL for submarines; again your Squadron M.O. will decide if it should be included as a supplement to your AMAL.

ANGINA PECTORIS

If you are suspicious that the patient's symptoms are referable to a myocardial infarction (M.I.), review your history and physical. If you remain concerned that this is an M.I., review the M.I. treatment protocol and consider its use.

1. **TREATMENT PROTOCOL AT A GLANCE** (see detailed discussion of treatment below; this section is for quick reference)

Remember the "A-B-C's" of Basic Life Support.

Notify command of need for MEDEVAC.

Place patient at bed rest.

Sublingual Nitroglycerine (1/150 gr) every 5 minutes as needed up to 3 tablets total.

Start O_2 at 2 litre/min by nasal canula.

Start IV D5W at KVO

2. **DISCUSSION**

Relative myocardial ischemia from an imbalance in myocardial oxygen supply versus demand is believed to be the basis for angina pectoris (Angina). Risk factors are the same as for M.I. Angina is commonly described as substernal chest pain, pressure, tightness, or a burning sensation that may radiate to the left arm, neck, jaw, or elsewhere. The discomfort is relieved within 1-5 minutes of resting and/or by nitroglycerin.

The physical exam is usually normal. Cardiac examination, during an episode of pain, may reveal an S3 or S4 heart sound, a mitral regurgitant murmur, or a systolic heave that disappears as the pain subsides. The ECG is usually normal, but may show ST depression which later resolves. Cardiac enzymes are normal, although such testing is unavailable at sea.

Diagnosis is made on the assessment of the risk factors, the history and physical exam, the ECG, and the response to rest and nitroglycerin.

Variant or "rest" angina, also known as Prinzmetal's angina, is due to coronary artery spasm. There is a good response to nitroglycerin but not to rest. The ECG may show transient ST elevation.

Recurrent and frequent episodes of angina, referred to as unstable angina, may be a harbinger of impending M.I. These episodes

may occur given less cardiopulmonary stress or exertion than was present at the initial attack, and the symptoms may be less responsive to rest and nitroglycerin than in typical stable angina.

3. DIFFERENTIAL DIAGNOSIS

Typical angina must be differentiated from many other causes of chest pain including:

a) myocardial infarction
b) esophageal spasm
c) non-specific chest pain
d) spontaneous pneumothorax
e) see also differential diagnosis of M.I.

a) Myocardial Infarction - see M.I.

b) Esophageal spasm: The pain of esophageal spasm is felt substernally or in the epigastrium. The pain may follow a meal and is accompanied by dysphagia. The pain is often relieved by NTG, making differentiation from classic angina difficult. The concomitant dysphagia and lack of relationship to exercise may be helpful in diagnosis.

c) Non-specific chest pain - see NONSCP

d) Spontaneous pneumothorax - see Chest Infection

4. TREATMENT OF ANGINA PECTORIS

Remember the "A-B-C's" of Basic Life Support.

Arrange immediately to MEDEVAC the patient. The treatments outlined are intended to stabilize the patient while awaiting evacuation. However, MEDEVAC's are not always immediately available or operationally feasible. Always remain prepared to care for the patient for a prolonged period of time. The treatments as outlined are written for this contingency.

Angina is readily treated with rest, oxygen, and sublingual (SL) NTG. With the patient sitting up, a 0.4 mg ("1/150 grain") tablet is given SL. Establish I.V. access with D5W at KVO.

The resulting sublingual burning sensation and occasional throbbing headache that may occur with NTG are accompanied by a gradual easing of pain over 1-5 minutes. If relief is incomplete, the dosage may be repeated at 5 min intervals to a total of 3 tablets.

5. USUAL COURSE WITH TREATMENT

The pain of angina often resolves within 5 minutes with rest and NTG administration. A residual nagging substernal discomfort of low grade intensity may persist and should be treated with continued rest and NTG administration. Headache from NTG can be treated with acetaminophen 650 mg po q4h.

One day of rest and observation is sufficient if there is no recurrence of pain and a follow-up ECG is normal. Light duty should be recommended for the remainder of the deployment. Smoking and heavy exertion are to be avoided. Caffeine intake (coffee, colas) should be limited. The patient should avoid heavy meals and salty foods. Blood pressure, if elevated, should be controlled with hydrochlorothiazide 50 mg po qid and reduced salt.

6. COMPLICATIONS AND THEIR MANAGEMENT

Hypotension from repeated administration of NTG is a possibility. It is easily treated by placing the patient in the Trendelenburg position (head down, legs up). If necessary, a 300 cc bolus of saline can be administered IV. The short duration of action of NTG leads to normalization of the BP within 5-10 minutes.

Bradycardia (heart rate less than 60) - treat with Atropine 0.6 mg IV. Repeat after 5 minutes, if needed. If also hypotensive, treat as above with Trendelenburg and fluids.

If, after days of relief from pain, there is a gradual return of chest pain, the patient should be re-evaluated. If the history and physical point to angina and there is relief with rest and NTG, the initial treatment should be reinstituted.

Occasionally, there will be a rapid return of chest pain following an initial period of relief. If the pain is unrelieved by three doses of NTG, returns during the 24-hour period of bed rest, or after three doses of NTG, or if no more than an hour has passed since the initial pain subsided, then infarction may be impending. The ECG will likely show abnormalities in these patients and should be utilized if available. The treatment protocol for M.I. should now be employed.

NON-SPECIFIC CHEST PAIN

If you are suspicious that the patient's symptoms are referable to heart disease (M.I. or angina), review your history and physical. If you remain concerned, review the M.I. treatment protocol and consider its use.

1. DISCUSSION

Non-specific chest pain (NONSCP) is intended to encompass those disorders which are not serious and not a cause for MEDEVAC. This pain often annoys more than frightens the patient, and may be exacerbated by patient anxiety. This characteristic is often helpful in diagnosis.

Common causes of non-specific chest pain include:

a) musculoskeletal pain; costochondritis (Tietze's syndrome);
b) esophagitis;
c) esophageal spasm ("esophageal angina");
d) hyperventilation syndrome;
e) psychoneurotic disorder and;
f) epigastric lesions (cholelithiasis, peptic ulcer, etc.).

a) Musculoskeletal pain and the pain of costochondritis denote muscle, rib, or cartilage pain due to inflammation or trauma. The pain is often sharp, of moderate intensity, localized and exacerbated by manipulation of the chest wall, deep inspiration or upper extremity movement. There is often tenderness over the area of pain. The lung exam is normal. Treatment includes mild analgesics/anti-inflammatory drugs, heat therapy, and rest.

b) and c) The pain of esophagitis and esophageal spasm is felt substernally in the mid-chest and/or epigastrium. Esophagitis is caused by direct irritation from food or drink, by reflux of gastric contents, or by infection (the latter is uncommon in healthy people). There is a good response to liquid antacids, a fact which aids in diagnosis. Esophageal spasm may follow a meal and is accompanied by dysphagia. The pain is relieved by nitroglycerin, making differentiation from classic angina difficult. The concomitant dysphagia and lack of relationship to exercise may be helpful in diagnosis.

d) Hyperventilation syndrome is a relatively common cause of chest discomfort in anxious individuals, but may occur in anyone. The accompanying dizziness, breathlessness, palpitations, and weakness may be extremely distressing to the patient. The patient may also describe numbness or tingling around the mouth and the fingertips. A response to treatment with reassurance and re-breathing techniques is very helpful in diagnosis.

e) In psychoneurotic disorders, no physical etiology for chest pain is found. This diagnosis is best made by those skilled in psychiatric evaluation. It should be assumed that crew members with chest pain have a physical etiology for their complaint.

f) Patients with disorders that present with epigastric pain such as gastritis, peptic ulcer, pancreatitis, and cholelithiasis may occasionally complain of chest pain. In most of these disorders the abdominal exam is helpful. Any abdominal tenderness points to an intra-abdominal source for the pain. The key issue is to avoid overlooking an atypical presentation of M.I. The assessment of risk factors, the history and physical exam (chest and abdominal) are of limited value, and the ECG, if available, is the most helpful in this regard.

2. DIFFERENTIAL DIAGNOSIS

Non-specific chest pain is occasionally confused with:

a) myocardial infarction see M.I.
b) angina see ANGINA

It is always good clinical judgment to assume the worst. It is essential to first rule out serious causes for chest pain. This may avoid a delay in life-saving treatment being administered.

3. TREATMENT

Most of these disorders respond well to symptomatic therapy. Musculoskeletal pain responds well to aspirin and heat. Costochondritis may require a more effective anti-inflammatory agent than aspirin for optimal treatment (e.g., Motrin or indomethacin), but may be managed with aspirin, 3 tabs po q4h. Codeine 30-60mg po q4h may be added, if necessary.

Esophagitis is treated with a liquid antacid regimen, 1 oz po q1-4h prn, with about a 7 oz maximum per day. Coffee intake and smoking should be eliminated.

Esophageal spasm responds to NTG and a liquid or soft diet. Food should be chewed well and fluid intake with meals increased. NTG should be used sparingly, and a medical consult obtained when ashore. The spasm may last minutes to hours and resolve spontaneously.

Hyperventilation responds to reassurance and bag re-breathing. Rarely is medication indicated. If necessary, Valium 5 mg po may be given. Parenteral medication and oxygen therapy are unnecessary. The patient should be encouraged to treat recurrences with re-breathing on his own.

Treatment of epigastric disorders is addressed by the abdominal pain program and your medical library.

4. USUAL COURSE WITH TREATMENT

Most non-specific chest pain disorders improve with the above therapies. Simple reassurance that the disorder is not serious can be of great benefit.

5. COMPLICATIONS AND THEIR MANAGEMENT

Musculoskeletal pain, costochondritis, and esophagitis, although very distressing to the patient, are unlikely to produce complications.

Esophageal spasm can become nearly disabling requiring esophageal dilation by a specialist. If episodes become frequent and poorly responsive to NTG or a "waiting period," then a liquid diet may help.

Recurrent or prolonged hyperventilation episodes alarm the patient and surrounding personnel. They should not be ignored. Valium 5 mg po tid and an appropriate modification of duty may be necessary for a few days.

CHEST INFECTION

This category comprises not only chest infections, primarily pneumonia, but also pneumothorax. The database does not contain enough cases of pneumothorax to allow a separate category, so pneumothorax may be diagnosed by the computer as a chest infection. Due to limited space, the following treatment section will discuss only pneumonia and pneumothorax. Please refer to available texts for the treatment of other chest infections.

If you are suspicious that the patient's symptoms are referable to heart disease (M.I. or angina), review your history and physical. If you remain concerned, review the M.I. treatment protocol and consider adding it to the measures discussed below.

PNEUMONIA

1. DISCUSSION

Pneumonia is an alveolar infection caused by a bacterium, virus, or other non-bacterial pathogen. Pneumococcal (bacterial) pneumonia is most likely in the isolated case. Mycoplasma and viral pneumonia (both are non-bacterial) are more common in outbreaks of pneumonia involving groups of people. Chest pain as a symptom of pneumonia is due to pleural or bronchial irritation. The pain may be felt anywhere in the thorax and is exacerbated by coughing or deep breathing. The pleuritic component to the pain distinguishes it from M.I. or ANGINA. Additionally, pneumonia is characterized by coexisting or recent upper respiratory tract symptoms, malaise, anorexia, fever, chills, cough, and sputum production. Dyspnea, tachypnea, and tachycardia may be present.

Physical exam reveals varying degrees of rhonchi, wheezing, rales, dullness to percussion, vocal fremitus, and egophony. These signs are worse with bacterial pneumonia and generally less severe in case of a non-bacterial etiology. The rales and rhonchi typically do not clear with coughing.

A lung infiltrate is usually visible on chest roentgenogram. This study being unavailable aboard submarines will require increased dependence on the physical exam. The white blood cell count is elevated in bacterial pneumonia, but near-normal or depressed otherwise. Mycoplasma pneumonia is common in young adults and varies in severity from mild symptoms to seriously ill. A right lower lobe pneumonia will occasionally present as abdominal discomfort in a younger person.

2. DIFFERENTIAL DIAGNOSIS

Pneumonia is clinically distinguishable from other chest pain syndromes. The complex of malaise, anorexia, fever, cough, sputum production, rales, rhonchi, tachypnea, tachycardia, and pleuritic chest discomfort is diagnostic. Once the diagnosis of pneumonia has been made, the major differential diagnostic challenge is to distinguish a bacterial from a non-bacterial pneumonia. The sputum gram-stain is invaluable in this regard. For this reason, microscopic analysis of a gram-stained sputum specimen should be performed.

The sputum should be collected after coughing and should not have the appearance of saliva. A precleaned slide should be liberally smeared with sputum, allowed to air dry, heat-fixed, gram-stained, and examined first under low power (to select a suitable area for viewing) then under high power. Only slides with rare or no epithelial cells should be accepted for viewing. Multiple epithelial cells denote a poor sputum specimen; if this is seen a new specimen should be obtained.

Interpretation of a sputum smear requires experience. Basically, one is looking for:

a) white cells (stain red) with minimal or no bacteria, suggesting a viral or mycoplasmal etiology, or

b) white cells with abundant bacteria requiring further differentiation as to bacterial morphology and staining characteristics. Gram positive cocci are far and away the most common organisms in otherwise healthy subjects, but gram negative bacilli may be seen. A smear with predominantly gram negative cocci or gram positive bacilli usually suggests a specimen contaminated with saliva since these are common organisms in the upper respiratory tract but rarely cause pneumonia, or

c) no white cells but many bacteria, or some white cells and a mix of different bacteria, both represent non-diagnostic smears. Another smear should be made in these cases.

In some instances, the patient cannot produce an adequate sputum specimen or the smear cannot be easily categorized. The following clinical generalities may help differentiate a bacterial from non-bacterial pneumonia when smear results are inconclusive:

a) Scanty sputum is seen more often in non-bacterial pneumonia.

b) A normal or minimally elevated temperature ($<101^{o}$ F) is seen more often in non-bacterial pneumonia.

c) Myalgias and headache are common with mycoplasmal or viral pneumonia, and less commonly seen in bacterial pneumonia.

d) Rusty brown sputum is typical in pneumococcal (a bacterial) pneumonia.

e) Pleuritic chest pain suggests bacterial pneumonia.

f) Severe shaking chills (rigors) are more typical of bacterial pneumonia.

3. TREATMENT OF PNEUMONIA

The treatment of pneumonia consists of bed rest, hydration, adequate nutrition, an antipyretic, an analgesic for pleuritic pain, if present, an expectorant and antibiotics when indicated. The patient must not smoke during the course of his illness! Oxygen should be used as indicated in patients who are dyspneic. This should be humidified and supplied by nasal canula though the method of delivery and the flow rate are dependent upon the degree of dyspnea.

The patient should be encouraged to cough and breathe deeply to avoid further inspissation of secretions. Cough suppressants should not routinely be used, but may be given if the coughing is exhausting the patient or producing severe pain. Antitussives may be of particular value when the patient wants to sleep but is unable to due to cough. If a guaifenesin and dextromethorphan (Robitussin DM, or its equivalent) is not available (not on submarine AMAL), then codeine 15-30 mg po q4-6h can be added to guaifenesin 1-2 tsp po q4h.

Bed rest is essential for at least 48-96 hours. Brief walks are advised; ladders are best avoided because of the often profound weakness accompanying pneumonia. Adequate po fluids, 16 oz po qid, are needed to loosen respiratory secretions. This will help to increase the productivity of the cough and hasten the clearing of secretions. At least one-half normal meal per day is needed. Aspirin or acetaminophen, 650 mg po q4h (when awake) relieve fever, headache and general discomfort.

An antibiotic is not indicated in viral pneumonia but is usually used in mycoplasma pneumonia and is always used in bacterial pneumonia. Viral and mycoplasma pneumonia are not distinguishable on clinical exam (chest x-ray, cold agglutinins, etc. are used ashore). Since an antibiotic is usually used in adults for mycoplasma pneumonia, it is best to start therapy when pneumonia is diagnosed at sea.

a. For mycoplasmal pneumonia:

Erythromycin 250-500 mg po qid (1st choice); or

Tetracycline 250-500 mg po qid (2nd choice if patient is allergic to or unable to tolerate erythromycin due to G.I. upset).

Duration of therapy is 10-14 days.

b. For a gram-positive bacterial pneumonia:

Penicillin 500 mg po qid.

If the patient appears particularly ill:

Penicillin G Procaine 500,000 units IM, followed by the oral regimen.

The penicillin-allergic patient should receive:

Erythromycin 500 mg po qid.

Duration of therapy is 10-14 days. It may require an extension of 7-14 days in some cases.

Remember, as with all antibiotics, completion of the course is essential to avoid recurrence and selection of resistant strains of bacteria. Patient compliance is often poor as the patient starts to feel better. You may have to take an active role in order to insure compliance. The extent of your involvement will be tailored to the individual, but don't take their compliance for granted.

c. Gram-negative bacterial pneumonia is a much more serious diagnosis and unusual in a previously healthy person. The gram stain of the sputum should be repeated with a fresh specimen to reaffirm the diagnosis. If the staining and decolorizing procedure is carefully accomplished and the sputum sample is good, then treatment should be initiated. Antibiotic therapy should be given parenterally. A two drug regimen of ampicillin and gentamicin will cover most gram-negative organisms and most gram-positive organisms should there be a misleading gram stain. Treatment regimen and dosages are as follows:

1) Ampicillin-Gentamicin regimen:

   a) Ampicillin 1-2 grams IV (slow infusion) q6h

   b) Gentamicin 1.5 mg/kg q8h IV (or IM). (For IV, dilute with 50-200 ml of IV solution and infuse over 30-60 min.).

2) Erythromycin or Cefoxitin may be substituted for penicillin in the penicillin allergic patient.

   a) Erythromycin 500 mg po qid, if the patient is able to tolerate oral medication; or

   b) Cefoxitin (Mefoxin) 1-2 grams IV q6-8 hours. Cefoxitin should only be used if the patient is quite ill and cannot tolerate oral erythromycin. There is a 15-20%

cross allergenicity with penicillin. Review the treatment of anaphylaxis below before using this drug in a penicillin allergic patient.

Be prepared to handle a severe allergic reaction:

a) Start with a small test dose (e.g. 0.1%-1% of anticipated dose) if you suspect an allergy.

b) Remember the A-B-C's of basic life support.

c) Have two large bore (16G-18G) catheters in place with two 1000cc bags of saline hung at KVO; bolus therapy may be necessary to maintain blood pressure should patient become hypotensive.

d) Epinephrine (1:1,000) 0.3-0.5 mg (0.3-0.5 ml) SC q20-30 min, or

Epinephrine (1:10,000) 0.5 mg (5 ml) IV q 5-10min, if life-threatening.

e) Benadryl 50 mg IM or PO (IV if life-threatening) q6h.

Parenteral therapy should be continued for 14 days. Monitoring the WBC count every 24-48 hours may help in assessing the adequacy of therapy. Ensure adequate fluid intake using IV fluids if necessary to maintain urine output (.5ml/kg body wt/hour is usually considered adequate urine output). The IV site should be changed every 72 hours during this period. A medical consult should be obtained when ashore as this illness is unusual in healthy people.

These patients have the potential of becoming gravely ill. Do not hesitate to MEDEVAC if patient is showing signs of deterioration either in level of consciousness or respiratory status or shows evidence of hemodynamic compromise (septic shock).

Pleuritic chest pain can be quite disabling if left untreated, leaving the patient reluctant to cough or breathe deeply. Aspirin 650-975 mg po q4h will help somewhat. Codeine 15-60 mg po q4h may be added to the aspirin, if necessary. Ideally, Motrin 400 mg po q4-6h or Indocin 25-50 mg po q8h should be used (if available) rather than aspirin or codeine. With the latter, sufficient pain relief requires dosages more likely to cause GI side effects and over-inhibition of coughing.

4. USUAL COURSE WITH TREATMENT

Viral and Mycoplasma pneumonia are generally self-limiting illnesses regardless of therapy. In 1-2 weeks the patient is well and may return to duty. Fatigue may persist for another 1-2 weeks, so

continued rest is important. Limited duty with half-watches may be recommended at first until strength is normal.

Gram-positive pneumonia responds well to the general measures plus antibiotic therapy as outlined. A classic defervescence occurs after a few days of antibiotics. It is important that the patient continues to get sufficient rest even after he is feeling better. Again, limited duty may be appropriate.

Gram-negative pneumonia responds more slowly to antibiotic therapy as the patient is generally sicker to begin with. A modification of therapy should not be undertaken for at least 48-72 hours unless the course continues downhill. Gradual recovery in 10-14 days is usual but not guaranteed. If recovery seems near complete at 14 days, there isn't a need to continue antibiotic therapy. Such patients should be carefully monitored for another two weeks with rest and limited duty.

5. COMPLICATIONS AND THEIR MANAGEMENT

Complications from pneumonia are generally prevented by early institution of appropriate antibiotic therapy. Complications that may occur can be separated into two categories:

a. Progression of the pneumonic infection marked by worsening cough, fever, tachycardia, dyspnea, tachypnea, cyanosis, and impaired consciousness. Humidified oxygen should be delivered by a face mask at 5-10 liters/min. If the patient is on oral antibiotics, he should be switched to intravenous penicillin and gentamicin as outlined above.

Fluid intake should be monitored carefully. Fever and tachypnea increase fluid loss, and therefore increase the fluid intake requirements. Monitor urine output and other indicators of hydration status to insure adequate hydration. Avoid over-hydration. The patient should be sitting up at a 30-45 degree angle to assist breathing.

As it is now mandatory to isolate the causative organism and administer specific therapy, arrangements for MEDEVAC should be made at once.

b. Empyema refers to a purulent effusion in the pleural cavity. Pneumococcus is the most common offending organism, and empyema complicates 3-5% of pneumococcal pneumonias. It occurs by extension of the pulmonary infection into the pleural space. It is seen clinically as relapse following an initial improvement or as a failure to improve after several days of antibiotic therapy. This is in contrast to the progressive downhill course in fulminant infection due to an antibiotic-resistant organism. Treatment is usually effective with high doses of antibiotics. Surgical drainage through repeated needle aspirations or chest tube placement is occasionally necessary, MEDEVAC is therefore warranted.

Chest roentgenogram, physical examination, and analysis of a sample of pleural exudate are used ashore for diagnosis. Of these measures, only a physical exam can routinely be employed at sea. If the patient continues to appear ill, has persistent fever, and leukocytosis, with unilaterally (more rarely bilaterally) decreased breath sounds and dullness to percussion at the lung base, empyema should be assumed to be present. Most organisms causing bacterial empyema are sensitive to penicillin. High doses by the intravenous route must be employed. The regimen employed is:

a) Penicillin G - 3 million units IV q4h (12 million total). The therapy should continue for 10-14 days from diagnosis.

b) Cefoxitin (Mefoxin) - 1-2 grams IV q6-8 hours. Cefoxitin should only be used if the patient is quite ill and cannot tolerate oral erythromycin. There is a 15-20% cross allergenicity with penicillin. Review the treatment of anaphylaxis below before using this drug in a penicillin allergic patient.

Be prepared to handle a severe allergic reaction:

a) Start with a small test dose (e.g. 0.1%-1% of anticipated dose) if you suspect an allergy.

b) Remember the A-B-C's of basic life support.

c) Have two large bore (16G-18G) catheters in place with two 1000cc bags of saline hung at KVO; bolus therapy may be necessary to maintain blood pressure, should patient become hypotensive.

d) Epinephrine (1:1,000) 0.3-0.5 mg (0.3-0.5 ml) SC q 20-30 min, or

Epinephrine (1:10,000) 0.5 mg (5 ml) IV q 5-10 min, if life-threatening.

e) Benadryl 50 mg IM or PO (IV if life-threatening) q 6 hour.

Should the patient already be on other antibiotics for pre-existing pneumonia, these may be continued. There is no firm rule for handling this complication.

Improvement on high dose penicillin may be seen in 48-72 hours; if it is not, the need for surgical drainage is likely.

PNEUMOTHORAX

1. DISCUSSION

Pneumothorax involves collapse of a lung secondary to entrance of air into the potential space between visceral and parietal pleura. Spontaneous pneumothorax develops de novo from rupture of an existing pulmonary bleb or occurs during respiratory infection. Coughing or other mechanisms which produce increased intra-alveolar pressure may be precipitating factors. Penetrating chest trauma, rib fracture, and barotrauma from diving accidents are other causes of pneumothorax.

Typically, the patient may complain of an acute onset of pleuritic chest pain on the involved side. Dyspnea, tachypnea, and cyanosis may be present with a large pneumothorax. The severity of the patient's condition on presentation is dependent on the degree of respiratory compromise and on the degree to which the lung has collapsed (i.e., the size of the pneumothorax).

Physical exam reveals absent breath sounds and tympany overlying the pneumothorax, upper fields in the upright patient. The trachea may be deviated away from the affected side. There is no fever or accompanying respiratory infection, unless pre-existent. Subcutaneous emphysema may be present in the chest wall or neck area if the parietal pleura is torn. The ECG will show sinus tachycardia.

The pneumothorax is visible on chest roentgenogram. Diagnosis can be made entirely on the basis of physical exam, though some small pneumothoraces may be undetectable by the inexperienced examiner. White blood cell count is normal unless there is acute distress, whereupon it might be elevated moderately. Occasionally, a "one-way valve" effect exists leading to the life-threatening tension pneumothorax. Usually, the non-tension pneumothorax stabilizes within a few minutes.

2. DIFFERENTIAL DIAGNOSIS

Other diagnoses which can mimic symptoms of pneumothorax are those in which an element of pleuritic chest pain and/or dyspnea are present. They include:

a) musculoskeletal chest pain;
b) pleurisy;
c) pulmonary embolus;
d) mediastinal emphysema

a) Musculoskeletal chest pain and the pain of costochondritis denote muscle, rib, or cartilage pain due to inflammation or trauma. The pain is often sharp, of moderate intensity, localized and exacerbated by manipulation of the chest wall, deep inspiration, or upper extremity movement. There is often tenderness over the area of pain. The lung exam is normal. Treatment includes mild

analgesics/anti-inflammatory drugs, heat therapy, and rest.

b) Pleurisy denotes inflammation of the pleura. It may be seen in the setting of bronchitis or pneumonia. The symptoms of both assist in differentiating pleurisy from pneumothorax. In the absence of signs of pneumonia or bronchitis, the lung exam is normal except for an audible friction rub on auscultation. Treatment includes rest, analgesics, an antitussive medication, and treatment of the underlying infection if identified.

c) Pulmonary embolus is heralded by an acute onset of dyspnea, pleuritic chest pain, apprehension, cough, and, occasionally, hemoptysis. Substernal chest pain is present in less than 5% of the cases. Upon exam, tachypnea, tachycardia, diaphoresis, and rales may be noted. There will be no areas of absent breath sounds, a fact which helps to differentiate this syndrome from a pneumothorax.

Differentiation from M.I. may be difficult but the dyspnea and tachypnea are prominent, whereas in M.I. pain is the chief complaint. If thrombophlebitis is noted, pulmonary embolism is more likely. The ECG will be normal or show tachycardia with or without T wave changes.

Treatment includes bed rest, oxygen, leg elevation, pain medication, and anticoagulation therapy. Since anticoagulation cannot be accomplished safely aboard ship, MEDEVAC should be arranged.

d) Spontaneous mediastinal emphysema is unlikely to occur except in divers or due to trauma. The presentation involves precordial chest pain, with or without a pleuritic component, in an otherwise healthy individual. Subcutaneous emphysema may be palpable as crepitus at the base of the neck, and a voice change with hoarseness may be noted. A mediastinal crunch may be noted upon auscultation. The ECG is normal. Treatment with oxygen, an analgesic, and reassurance is usually adequate.

3. TREATMENT OF PNEUMOTHORAX

Most cases of pneumothorax stabilize within minutes or so, leaving a degree of pleuritic chest pain, dyspnea, tachypnea, and tachycardia. The extent of symptomatology depends upon the extent of the pneumothorax. In a young, healthy person, simple bed rest, reassurance, and a mild analgesic suffice. Oxygen at 2 liters/min. by nasal cannula should be used for up to 24 hours. An antitussive (i.e., codeine 15 mg po q4h) should be added if a cough is problematic. Monitoring the patient every 15 minutes for the first few hours of symptoms is important. If stable for 6 hours, less frequent monitoring (qid x 1 day) is fine. It is wise to limit duty until symptoms resolve and the breath sounds are normal. This may take 2-7 days.

4. USUAL COURSE WITH TREATMENT

Most cases of pneumothorax require close observation for a few hours, minimal treatment, then limited duty for several days until symptoms clear.

5. COMPLICATIONS AND THEIR MANAGEMENT

The complications of a pneumothorax are:

a) respiratory compromise dependent on the extent of the pneumothorax; and

b) tension pneumothorax.

a) Healthy adults can sustain complete collapse of one lung without threat to life. The complete collapse may occur at once or as the pneumothorax expands slowly from a continued air leak. Most small punctures in the visceral pleura producing air leaks will tend to close over as the lung shrinks in size. Some leaks, particularly larger ones, will persist and the pneumothorax, and hence the degree of lung collapse and respiratory distress, will continue to increase. Symptoms will be sudden unilateral pleuritic chest pain and dyspnea at presentation. Worsening dyspnea will indicate that the pneumothorax is not stable. Unilaterally absent breath sounds and hyper-resonance to percussion are noted. The trachea should not be deviated, no hypotension should be noted, and the patient should not appear cyanotic. If any of these latter signs are present consider tension pneumothorax as described below.

Treatment includes bed rest, oxygen by face mask at 5-10 liters/min, and frequent monitoring of vital signs and respiratory status. Since morbidity is greatly prolonged without chest tube placement, and since the placement of a tube is not a trivial procedure, a recommendation to MEDEVAC should be made. If the patient labors too long in attempting to breathe, respiratory muscle fatigue may ensue. Remember the "A-B-C's" of BLS. You may have to assist ventilation if the patient becomes exhausted or loses consciousness, though respiratory arrest is not an expected complication. Positive pressure ventilation with an AMBU bag can produce a tension pneumothorax, so monitor the patient with great care. If this situation occurs prior to MEDEVAC, while maximal O_2 therapy has been used, then the protocol below (tension pneumothorax treatment) should be employed as a last resort.

b) Tension pneumothorax is a life threatening complication. It results from a "one-way valve" effect wherein air enters the pleural space with each inspiration but cannot be expelled with expiration. The pressure in the pleural space progressively increases and exceeds atmospheric pressure. This excessive positive pressure within the chest prevents adequate ventilation of the contralateral lung and produces hemodynamic compromise. Onset may be sudden or insidious. Exam

reveals a patient severely dyspneic, tachypneic, tachycardic, hypotensive, and cyanotic. Breath sounds will be absent from the effected side and hyper-resonance to percussion will be noted. The trachea is deviated away from the affected side, and neck veins will be distended.

Removal of air may be life-saving; failure to do so may well prove fatal to the patient. Following treatment, a MEDEVAC should be arranged.

Air may be removed by a procedure called needle thoracostomy. Though potentially life-saving this is not the definitive procedure. The patient ideally should have a chest tube placed. Arrange for the patient to be MEDEVAC'ed.

1) A 19-gauge or larger needle (with IV catheter) is inserted through the chest wall to allow the relief of the pressure within the pleural space. Attach a three way stopcock and syringe to the needle and open the stopcock to the air.

2) One of two sites are generally used, either the **second intercostal space in the mid-clavicular line** or **fifth intercostal space in the mid-axillary line** of the affected side.

3) Without wasting valuable time prepare the area prior to inserting the needle.

4) The needle must be inserted at the superior margin of the inferior rib. The intercostal arteries and veins lie just inferior to the ribs and must be avoided.

5) Advance the needle until a pop and decreased resistance are felt. Often a rush of air is heard. The patient should show rapid, marked improvement in respiratory and hemodynamic status.

6) Aspiration with the attached syringe may yield further benefit. When no more air can be suctioned, the needle is removed leaving the catheter in place. You have now converted a tension pneumothorax into an open pneumothorax.

7) The catheter may now be attached to IV tubing, the other end of the tubing placed below a water seal using a bottle of sterile saline (not a bag). The tip of the tubing must be below the surface of the water. This allows air to escape and prevents the tension pneumothorax from recurring. Alternatively a Penrose drain or the finger cut from a surgical glove can be used as a one-way flutter valve. It is also acceptable to replace the three-way stopcock on the catheter and open it as needed if air begins to reaccumulate. Diligent monitoring and careful physical exam will be

required at this stage.

8) The catheter hub may be affixed to the chest wall via a skin suture with a tight loop about the hub. This prevents accidental removal and recurrent tension pneumothorax. The catheter should be left in for at least 72 hours while awaiting MEDEVAC.

CAUTION: Because of the obvious risks associated with the above procedure, it should only be attempted when the diagnosis is reasonably certain and the crew member is in extremis. Failure to recognize and treat a tension pneumothorax invariably is fatal.

APPENDIX B

DATA SHEET DEFINITIONS

The definitions listed below are intended for use in the context of the program. In some cases, they may differ from the traditional usage or your training. Additionally, some terms may seem to be included in an inappropriate category. This is due to the nature of the statistical analysis performed by the program and the way it weighs different findings in relation to one another. Do not use this section in place of a medical dictionary or a physical examination text. HOWEVER, it is important that you and the computer are "speaking the same language," so familiarize yourself with this section.

HISTORY PAGES

PAGE ONE

SITE OF PAIN definition:

CENTRAL
CHEST
ACROSS
LT. SIDE
RT. SIDE
EPIGASTRIC
OTHER

Get the patient to bare his chest and ask him to indicate with one finger where the pain is. Choose a category which fits best. Remember that larger areas take precedence over smaller ones. Record the widest area you note. For example, if the pain is right across the chest, do not record the 'left' and 'right' side separately, record 'across' the chest.

RADIATION OF PAIN definition:

NONE	NECK
LT. ARM	JAW
RT. ARM	THROAT
BOTH ARMS	FINGER/HANDS
BACK	EPIGASTRIC
CHEST	OTHER
SHOULDERS	

RADIATION is pain spreading from a primary site, such as the chest, to other areas. Patients often describe this pain as 'moving' or 'striking' or 'shooting' to the area in question. Ask specifically about each of the possible choices above. As with the primary site of pain, record the largest area noted. For example, if the pain goes down both arms record 'both arms', do not record 'left arm' and 'right

arm' separately.

PAGE TWO

DURATION OF PAIN definition:

1 H OR LESS	12 - 24 H
1 - 2 H	24 - 1 W
2 - 4 H	1 W OR MORE
4 - 12 H	

In assessing DURATION OF PAIN, determine the length of time since the pain began. This includes only the present episode of illness.

If the patient has had previous episodes of pain weeks (or months) ago, do not include this in the duration of the present episode, but note under "Previous Chest Pain."

ONSET OF PAIN definition:

SUDDEN
GRADUAL

Determine how long it took the pain to develop fully. Usually, if this took less than two minutes you should note "sudden" - if it took more than two minutes it should be "gradual."

It is often a good plan to ask a patient what he was doing when the pain began. If the patient can remember this vividly, it indicates a sudden onset (though a vague answer tells you nothing).

TIME COURSE OF PAIN definition:

CONTINUOUS
INTERMITTENT

If your patient has had specific times (usually at least a few minutes ranging up to a few hours) when he has been free of pain, since the present episode started, the pain is intermittent. Otherwise, assess as continuous.

Beware of the patient with a long history of "intermittent" pain. If this goes back for more than a week, you should question whether this is acute chest pain at all.

TYPE OF PAIN definition:

TIGHT	GRIPPING	DULL
SHARP	BURNING	STABBING
HVY/PRESS/CRUSH	ACHING	NAGGING

These are subjective categories. Ask the patient to describe the TYPE OF PAIN using one of these nine adjectives.

NUMBNESS definition:

PRESENT
ABSENT

This refers to the present illness only. Your patient may describe an absence of sensation or a 'tingling' in some areas. This is a subjective phenomenon. Some people call it "pins and needles."

Ask the patient if he feels any numbness/tingling/pins and needles in any area of the body. Ask particularly about the trunk and arms, especially the arms and hands.

PAGE THREE

SEVERITY OF PAIN definition:

MODERATE
SEVERE

Do not ask the patient directly and do not expect to rely on the answer if you do. If the pain is obviously intense and is causing obvious distress, such as sweating or shivering, then it is severe; otherwise it is moderate. The difficulty in distinguishing between mild and moderate pain is so great that we prefer to call all pain moderate or severe. Be especially wary of relying on the patient's description since the threshold for pain varies greatly between people. A patient with mild or moderate pain may make a great deal of fuss about it. The patient who is quiet may be in severe pain. Use your own judgment.

AGGRAVATING FACTORS definition:

MOVEMENT
COUGH
BREATHING
SITTING
LYING DOWN/REST
LEANING FORWARD
OTHER
NONE

This category refers to activities which make the pain worse. Ask about each of the above items in a natural manner, e.g. "Does 'X' affect your pain?"

Remember that some patients tend to say "yes." It is best to ask the patient to do something (e.g. take a deep breath) and if this appears to cause pain remember to ask where the pain is felt. For example, pain on deep breathing has a totally different significance if felt in the lateral side of the chest or in the RUQ of the abdomen.

PROGRESS definition:

BETTER
SAME
WORSE

This refers to the overall progress of pain since the start of the present episode.

RELIEVING FACTORS definition:

NITRO
REST
WALKING
MORPHINE
OTHER DRUGS
OTHER

This re'ers to patient activities which ease the pain. Ask about each of the above items in a natural manner, e.g. "Does 'X' affect your pain?"

Remember we are only talking about the present episode. For example, if pain is usually eased by a nitroglycerin tablet put under the tongue, but not on this occasion, it should be recorded as "no relieving factors."

PAGE FOUR

DYSPNEA definition:

ABSENT
THIS ILLNESS
CHRONIC

This is shortness of breath while not engaged in any activity. Ask "have you felt unusually short of breath, especially while resting?" It is also important to distinguish between chronic dyspnea and dyspnea which has started recently.

In general, it is wise (though not relevant to the computer program) to distinguish between dyspnea on moderate activity (such as climbing stairs or walking uphill), dyspnea on mild activity (walking about on the flat), and dyspnea at rest. Also, be particularly wary of shortness of breath which occurs when the patient lies down flat for this may indicate pulmonary congestion of a serious degree.

COUGH definition:

ABSENT
THIS ILLNESS
CHRONIC

Here it is important to distinguish between a chronic cough and a cough which has recently started. As part of a complete history, you should also distinguish between a dry cough and a productive cough (this is one which is accompanied by sputum).

SPUTUM definition:

PRESENT
ABSENT

Sputum is fluid coughed up from the respiratory tract. The consistency and color may vary. In acute heart failure or after a pulmonary embolus, the sputum is often frothy and white, or tinged with red. In chest infection, it is more usually viscid (thicker) and may be either yellow or green in color. Only put PRESENT if sputum is a part of the current illness.

ORTHOPNEA definition:

PRESENT
ABSENT

Orthopnea is breathlessness which occurs when the patient is lying flat so that it prevents the patient from lying down comfortably. The patient has to be propped up in bed (usually with several pillows) or has to sit upright in a chair. The breathlessness

usually signifies left sided heart failure. When the patient lies flat, fluid builds up in the lungs due to poor performance by the left side of the heart, causing breathlessness.

PND - PAROXYSMAL NOCTURNAL DYSPNEA definition:

PRESENT
ABSENT

Attacks of breathlessness at night. The patient usually awakes with a feeling of suffocation and gasps for breath. It is commonly associated with wheezing which can indicate bronchospasm. It differs from Orthopnea in that the symptoms are not usually relieved by sitting up.

REFLUX definition:

PRESENT
ABSENT

Reflux of small quantities of gastric contents and acid from the stomach may cause a bitter taste in the back of the throat. Reflux needs to be carefully distinguished from VOMITING, which is accompanied by retching, often nausea, and consists of partly digested food, and SPUTUM, which is coughed up from the lungs and air passages.

PAGE FIVE

NAUSEA definition:

PRESENT
ABSENT

The presence of NAUSEA means your patient is feeling sick to his stomach. NAUSEA may be accompanied by weakness, sweating, and profuse salivation. It may, or may not, be accompanied by vomiting.

VOMITING definition:

PRESENT
ABSENT

Vomiting indicates that the patient is being sick to his stomach with an appreciable amount of stomach contents being expelled. This should be distinguished from "burping" up small amounts of acid material, which is not vomiting but reflux.

APPETITE definition:

NORMAL
DECREASED

In assessing appetite, you should be interested in recent change in appetite. Determine what is normal or usual for this patient and then assess if there has been a recent change in the patient's desire to eat.

Only if there has been a recent decrease in the patient's desire to eat should you mark "decreased", otherwise mark "normal."

BOWELS definition:

NORMAL
CONSTIPATED
DIARRHEA

Enter only a recent change in bowel habits. Ask about the patient's normal bowel habits and then ask about the last 24-48 hours. If there has been a marked decrease in the number of stools, circle constipated - and if a marked increase circle diarrhea. Remember to distinguish between loose and watery stools in your record and diagnosis. If you are unsure, it is best to indicate normal, since bowel habits in the normal population tend to vary widely.

PAGE SIX

PREVIOUS CHEST PAIN definition:

YES
NO

Check carefully for times in the past when your patient has experienced chest pain. Incidents may be forgotten and sometimes they are concealed by the patient.

It is especially relevant to ask about two types of pain:

1) previous episodes in the past similar to the present attack, and
2) episodes of vague chest pain in the weeks prior to the present incident.

Only the first is relevant to the computer program, but the second is important to your evaluation of the patient, irrespective of the program output. Many doctors feels that this vague "prodrome" may be a forerunner of cardiac problems.

PREVIOUS CARDIO-RESPIRATORY ILLNESS definition:

YES
NO

This refers only to a significant illness involving the cardio-vascular or respiratory systems. Ask about, and check the patient's health record for major illnesses in the past such as high blood pressure, angina, pericarditis, pneumonia, pneumothorax, pulmonary embolism, and asthma.

PREVIOUS MAJOR SURGERY definition:

YES
NO

This refers to major surgery of any kind. Ask about, and check health records for, major surgery in the past.

SMOKER definition:

YES
NO

In the context of this program, a smoker is defined as a person who smokes 10 or more cigarettes per day.

POSITIVE HISTORY FOR definition:

MI
ANGINA
BRONCHITIS
HYPERTENSION
DIABETES

Ask the patient about each item specifically.

PHYSICAL PAGES

PAGE ONE

TEMPERATURE definition:

NORMAL
INCREASED (> 99.6° F)
DECREASED (< 97.8° F)

Select the appropriate category.

PULSE RATE definition:

< 61
61 - 70
71 - 80
81 - 100
> 100

Select the appropriate category (beats per minute).

RESPIRATION definition:

< 20
20
21 - 25
26 - 30
> 30

Select the appropriate category for respiratory rate (breaths per minute).

BLOOD PRESSURE (systolic) definition:

< 100
101 - 120
121 - 140
141 - 160
> 160

Select the appropriate category (mmHg).

BLOOD PRESSURE (diastolic) definition:

< 71
71 - 80
81 - 90
91 - 100
> 100

Select the appropriate category (mmHg).

PAGE TWO

ECG definition:

ST ELEVATION
T DEPRESSION
Q WAVES
ST DEPRESSION
ARRHYTHMIA
WITHIN NORMAL LIMITS

ST Elevation: The ST segment is the section of the tracing between the QRS complex and the T wave. It is elevated if, with respect to the T-P segment, the ST segment rises more than 1 mm in the standard leads or more than 2 mm in the chest leads. In shape, the normal ST curves gently into the proximal limb of the T wave. A strictly horizontal ST which forms a sharp angle with the proximal limb of the T wave is called "plane depression" and is strongly indicative of myocardial ischemia.

T Depression: The T wave follows the QRS complex and represents the repolarization phase of the ventricles. In adults, T waves are normally upright in leads I, II, and V3 - V6; inverted in aVR; and variable (upright or inverted) in III, aVL, aVF, V1, and V2.

Mark T waves depressed if the T waves are inverted in leads I, II, or chest leads V3 - V6.

Q Wave: The Q wave is thought to be caused by the initial depolarization of the ventricular septum. When present, the Q wave is the first downward or negative deflection after the P wave. Very small, insignificant Q waves may be present normally in certain leads (I, II, V5, V6).

A significant Q wave is 1 mm wide (.04 sec) or one-third the size of the QRS complex. The presence of significant Q waves is diagnostic of myocardial infarction. Scan all leads (except lead aVR for which Q wave data may be unreliable) for the presence of Q waves.

ST Depression: The ST segment is the section of the tracing between the QRS complex and the T wave. It is depressed if the ST segment is below the T-P segment by more than 1 mm in the standard leads or by more than 2 mm in the chest leads. ST segment depression can be caused by digitalis, acute posterior infarction (depression in V1 or V2), sub-endocardial infarction (flat depression of the ST segment), or ventricular strain (moderate depression).

Arrhythmia: An arrhythmia is any variation from the normal rhythm of the heart. 13 abnormalities are defined and depicted in the chest pain program. They are: 1st Degree Heart Block, 2nd Degree Heart Block (Type I and Type II), 3rd Degree Heart Block, Atrial Flutter, Atrial Fibrillation, Ventricular Tachycardia, Ventricular

Fibrillation, Asystole, Sinus Tachycardia, NSR with Occasional PVC's, NSR with Occasional PAC's, and Sinus Bradycardia. For information purposes, NSR and NSR with 60 HZ interference are also depicted.

Within Normal Limits: By definition, the scope of Within Normal Limits is too broad to be encompassed within this paper. For any questions, please refer to appropriate textbooks. Mark this response only if the definition is met.

References:
American Heart Association, Textbook of Advanced Cardiac Life Support, AMA National Center, Dallas, TX., 1983.

Dubin, D., Rapid Interpretation of EKG's, third edition, Cover Publishing Co., Tampa, 1978.

Marriott, Henry J. L., Practical Electrocardiography, sixth edition, The Williams & Williams Co., Baltimore, 1977.

SGOT definition:

< 25
25 - 50
51 - 100
100 - 200
> 200

Serum Glutamic Oxaloacetic Transaminase was the first enzyme to be widely used as a laboratory diagnostic aid. It begins to rise 12 hours post injury, peaks at 2-4 times normal at 24 hours, and returns to normal in 4-7 days. It is also released from an injured liver and other cells and is thus a sensitive but non-specific indicator (potential false positive). The current terminology is "AST" or aspartate transferase. Facilities for its measurement typically are not available at sea.

MOOD definition:

NORMAL
ANXIOUS
DISTRESSED
IN SHOCK

If the patient is experiencing significant physical symptoms (such as pain, nausea or vomiting), circle DISTRESSED. If the patient is primarily worried about his illness, circle ANXIOUS.

Though not properly recorded as MOOD, "IN SHOCK" is entered here. Shock as defined below may effect the patient's general appearance.

Shock is an acute hemodynamic disturbance resulting in inadequate tissue perfusion. Patients in shock tend to have some or all of the

following: rapid, shallow pulse, diminished blood pressure (systolic below 95 mmHg), pallor, sweating and anxiety. A patient with a majority of these symptoms would usually be said to be "IN SHOCK".

COLOR definition:

NORMAL
PALE
FLUSHED
CYANOTIC

Check especially for pallor (unusual absence of color or paleness), flushing (unusual ruddiness), or cyanosis (blueness). In blacks, also check the mucus membranes, nail beds, nose, lips, conjunctivae. Studies have shown that artificial light (especially fluorescent light) may make this assessment difficult.

A cold environment may cause peripheral cyanosis (extremities) but not central cyanosis.

PAGE THREE

EDEMA definition:

ABSENT
ANKLES
OTHER

Excessive accumulation of fluid in body tissues, most commonly swollen ankles, usually noticed towards the end of the day. This is often resolved by elevation of the legs. In patients who are confined to bed, it may present over the sacrum or lower back, the most dependent (lowest) part of the body. If heart failure is far advanced, edema can even become generalized.

There are two types of edema, "pitting" (which indicates heart failure) and "non-pitting" (which indicates blockage of lymphatics). Only the former is significant in acute chest pain. To elicit "pitting" edema, press your thumb fairly hard on top of the swollen area. It will sink in somewhat. Wait a few seconds, then release. In "pitting" EDEMA, a marked depression (or pit) will remain in the skin, for at least 10-15 seconds.

SWEATING definition:

YES
NO

Diaphoresis. Do not record sweating that is due to an obvious cause (such as environmental heat or heavy exertion).

SHIVERING definition:

YES
NO

Rigors. Do not record shivering that is due to environmental conditions or shaking that is due to emotional upset. Thus, if the patient is shivering without obvious cause or due to a febrile illness record "YES".

RESPIRATORY MOVEMENT definition:

NORMAL
ABNORMAL

To examine for respiratory movement you should check the amount and pattern of chest expansion:

a) At the level of the nipples measure the amount of chest expansion with a tape measure or string. If the difference between full inspiration and full expiration is less than two inches, circle ABNORMAL (don't draw the tape tightly enough to push in on the skin).

b) Have the patient sit up and stand behind him. Place both your hands on the patient's back with your thumbs horizontal at the lower margin of his rib cage and meeting in the midline, the fingers spread fan-wise. Have the patient breathe in deeply and note: (1) whether the tips of the thumbs move apart as the chest expands and (2) whether this expansion is equal on both sides. If obviously different or reduced, record "ABNORMAL" and indicate which side, if either, is reduced.

PERCUSSION definition:

NORMAL
DULL
HYPER-RESONANT

Be sure to carefully percuss both the front and back of the chest. The best method is to compare sides as you go, left with right. If the sides don't sound the same, there may be an abnormality. The lungs should normally sound somewhat resonant. If an area sounds markedly less resonant than normal, circle DULL; if an area is markedly more resonant than normal, circle HYPER-RESONANT, otherwise circle NORMAL.

When percussing anteriorly, right and left sides are normally different in three areas: 1) dullness should be present to the left of the lower sternum over the heart; 2) dullness may be present over the liver above the anterior right costal margin; and 3) hyper-resonance may be present below the anterior left costal margin over the gastric bubble.

CHEST SOUNDS definition:

NORMAL
RHONCHI
RALES
DECREASED

Listen to breath sounds posteriorly throughout both lung fields as the patient breathes deeply. If one side is markedly decreased compared to the other, write DECREASED.

Rales are discrete, crackling sounds produced by moisture in airways of the lung. Rales are usually heard late in inspiration. If you suspect heart failure, fine rales should be checked for by listening to the lung bases and having your patient cough, then breathe deeply. Coarser rales can be heard elsewhere in the lung in conditions such as pneumonia.

Rhonchi are coarse sounds that range from coarse crackling to lower-pitched rattling. They can be heard anywhere over the lungs. Rhonchi are usually heard with infections such as bronchitis or pneumonia.

For the purpose of this program, wheezing is entered as RHONCHI. Wheezes are musical sounds that may range from a high-pitched squeak to a continuous low-pitched moan. They are more commonly expiratory. Wheezes are heard with emphysema, acute and chronic bronchitis, pneumonia, asthma, and congestive heart failure.

If you hear suspicious sounds, ask the patient to cough. Sounds that do not clear are usually significant.

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COLD/CLAMMY definition:

YES
NO

The patients skin feels cold (clammy) to the touch.

CALF TENDERNESS definition:

YES
NO

Calf tenderness is pain felt on pressure over either calf. (The calf is the thick muscular area over the back of the lower leg.)

In trying to elicit this sign, pay special attention to the MIDLINE - run your fingers down from the back of the knee to about 3

inches above the ankle, pressing moderately hard every 3-5 cm. If this causes definite pain, or if dorsi-flexion of the foot causes pain in the same area at the back of the calf (Homan's sign), calf tenderness is PRESENT.

This may indicate a deep venous thrombosis (DVT) and increase the likelihood of a pulmonary embolus.

CHEST WALL TENDERNESS definition:

YES
NO

Refers to tenderness anywhere in the chest on light to moderate pressure by the examiner's hand.

After trauma, this sign has a totally different significance (it may indicate a fractured rib). Leave this answer blank if there is tenderness, but you suspect that it is due to recent trauma.

JUGULAR VENOUS PRESSURE (J.V.P.) definition:

NORMAL
RAISED
LOW

Standing on your patient's right, have your patient reclining at a 45 degree angle, his chin turned about 30 degrees to the left, with a light shining at an angle across his neck so that his right neck vein casts a shadow. It is important to distinguish the external jugular vein from the carotid artery pulse. This can be accomplished by feeling for a pulse. The venous pulsation, though visible should be easily distinguishable from the arterial pulsation on palpation.

With the patient in this position and the external jugular vein identified, observe the meniscus of the venous pulsation, that is the highest point visible: if the meniscus of the vein is seen more than one half of the distance from the clavicle to the chin, circle RAISED. Otherwise, circle NORMAL. If you're not sure, omit this entry.

In a markedly hypotensive patient you will be unable to locate any trace of the external jugular vein, even when the patient is lying completely flat. This is usually because the vein is empty and the walls have collapsed. Under these circumstances, circle LOW; and check the patient's blood pressure carefully, taking the appropriate therapeutic steps.

HEART SOUNDS definition:

NORMAL
ABNORMAL

Cardiac auscultation is a fine art. With the diaphragm of your stethoscope, listen carefully to the first and second heart sounds (LUB-DUB, LUB-DUB; also known respectively as S_1 and S_2). These should be clearly audible and regular. If you can hear any extra sounds (murmurs, gallops, split sounds etc.) or if the heart sounds are irregular, circle ABNORMAL. Otherwise circle NORMAL.

Sometimes changing your patient's position makes auscultation easier. Have him sit up, lean forward, or lie on the left side, as needed.

If the heart is irregular, try and correlate the rhythm with the patient's respiration. Remember that in young healthy people the heart can speed up and slow down in time with respiration. This is called sinus arrythmia and is normal.

APPENDIX C
CHEST PAIN DATA SHEET

PATIENT NAME

CHEST PAIN DATA SHEET

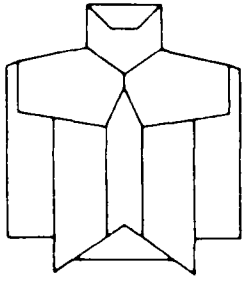
DATE TIME

SSN

HISTORY

AGE

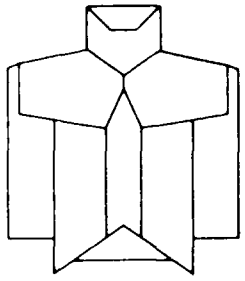
SITE OF PAIN



CENTRAL CHEST
ACROSS
LT SIDE
RT SIDE
EPIGASTRIC
OTHER

RADIATION

NONE
LT ARM
RT ARM
BOTH ARMS
BACK
CHEST
SHOULDERS
NECK
JAW
THROAT
FINGERS HANDS
EPIGASTRIC
OTHER



DURATION OF PAIN

1 H OR LESS
1 2 H
2 4 H
4 12 H
12 24 H
24 H 1 WK
1 WK OR MORE

ONSET OF PAIN

(sudden = 2 min gradual = 2 min)

SUDDEN
GRADUAL

TIME COURSE OF PAIN

(at times free of pain = intermittent
everything else = continuous)

CONTINUOUS
INTERMITTENT

TYPE OF PAIN

TIGHT
SHARP
HVY PRESS CRUSH
GRIPPING
BURNING
ACHING
DULL
STABBING
NAGGING

NUMBNESS

PRESENT
ABSENT

SEVERITY OF PAIN

(do not ask obvious distress = severe
everything else = moderate)

MODERATE
SEVERE

PROGRESS OF PAIN

BETTER
SAME
WORSE

AGGRAVATING FACTORS

MOVEMENT
COUGH
BREATHING
SITTING
LYING DOWN REST
LEANING FORWARD
OTHER
NONE

RELIEVING FACTORS

(ask about each)

NITRO
REST
WALKING
MORPHINE
OTHER DRUGS
OTHER
NONE

OTHER SYMPTOMS

DYSPNEA

(recent = this illness
chronic = habitual)

ABSENT
THIS ILLNESS
CHRONIC

ORTHOPNEA

(inability to breathe except
when upright)

PRESENT
ABSENT

COUGH

(recent = this illness
chronic = habitual)

ABSENT
THIS ILLNESS
CHRONIC

PND

(paroxysmal nocturnal dyspnea)

PRESENT
ABSENT

SPUTUM

PRESENT
ABSENT

REFLUX

PRESENT
ABSENT

NAUSEA

PRESENT
ABSENT

APPETITE

(recent change)

NORMAL
DECREASED

VOMITING

PRESENT
ABSENT

BOWELS

(recent change)

NORMAL
CONSTIPATED
DIARRHEA

PAST HISTORY

PREVIOUS CHEST PAIN

YES
NO

SMOKER

YES
NO

PREVIOUS CARDIO RESPIRATORY ILLNESS

YES
NO

POSITIVE HISTORY FOR

MI
ANGINA
BRONCHITIS
HYPERTENSION
DIABETES

PREVIOUS MAJOR SURGERY

YES
NO

(PLEASE TURN OVER FOR PHYSICAL EXAM PORTION)

PHYSICAL EXAM

VITAL SIGNS

TEMPERATURE

- NORMAL
- INCREASED (>99.6° F)
- DECREASED (<97.8° F)

PULSE RATE

- < 61
- 61 70
- 71 80
- 81 100
- > 100

RESPIRATION

- < 20
- 20
- 21 25
- 26 30
- > 30

BLOOD PRESSURE (SYSTOLIC)

- < 100
- 101 120
- 121 140
- 141 160
- > 160

BLOOD PRESSURE (DIASTOLIC)

- < 71
- 71 80
- 81 90
- 91 100
- > 100

LAB

ECG

- ST ELEVATION
- T DEPRESSION
- Q WAVES
- ST DEPRESSION
- ARRHYTHMIA
- WITHIN NORMAL LIMITS

SGOT

- < 25
- 25 50
- 51 100
- 101 200
- > 200

GENERAL EXAM

MOOD

(don't ask, obvious distress or physical symptoms = distressed concern about illness = anxious)

- NORMAL
- ANXIOUS
- DISTRESSED
- IN SHOCK

COLOR

(consider environmental temp, check conjunctiva & palms on black & oriental)

- NORMAL
- PALE
- FLUSHED
- CYANOTIC

EXAMINATION

EDEMA

- ABSENT
- ANKLES
- OTHER

SWEATING

(sweating not due to environment or exercise)

- YES
- NO

SHIVERING

(shivering not due to environment or exercise)

- YES
- NO

RESPIRATORY MOVEMENT

(abnormal = diff. between full inspir & full expir is < 2 inches or expansion is unequal between sides; everything else is normal)

- NORMAL
- ABNORMAL

PERCUSSION

(percuss both front & back; dull = less resonant than normal; hyper resonant = markedly more resonant than normal; everything else is normal)

- NORMAL
- DULL
- HYPER RESONANT

CHEST SOUNDS

(compare left to right sides; rhonchi = cont. musical sounds; rales = discrete, non-cont. sounds; decreased = 1 side markedly dec.)

- NORMAL
- RHONCHI
- RALES
- DECREASED

COLD CLAMMY

- YES
- NO

CALF TENDERNESS

- YES
- NO

CHEST WALL TENDERNESS

- YES
- NO

JUGULAR VENOUS PULSE

(pt. reclines at 45 deg., chin at 30 deg. to left; meniscus more than 1.2 dist. from clavicle to chin = elevated; everything else = normal)

- NORMAL
- RAISED
- LOW

HEART SOUNDS

(listen with stethoscope to 1st & 2nd heart sounds; normal = lub-dub, lub-dub; everything else = abnormal)

- NORMAL
- ABNORMAL

CORPSMAN'S EVALUATION

MARK YOUR DIAGNOSIS

- ( ) MYOCARDIAL INFARCTION
- ( ) ANGINA
- ( ) NON SPECIFIC CHEST PAIN
- ( ) CHEST INFECTION

MARK YOUR EVALUATION

- ( ) EVACUATION
- ( ) NO EVACUATION

YOUR TREATMENT

- ( ) OBSERVE ONLY
- ( ) MEDICATE
- ( ) PROCEDURE

DATA SHEET SEEN BY C.O.?

- ( ) YES
- ( ) NO

RECOMMENDATION OF MEDICAL OFFICER

- ( ) EVACUATION
- ( ) CHEST PAIN TREATMENT
- ( ) TREATMENT FOR OTHER
- ( ) RETURN TO DUTY
- ( ) NOT CONSULTED

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE

REPORT DOCUMENTATION PAGE

Form Approved OMB No 0704-0188

1a REPORT SECURITY CLASSIFICATION: UNCLASSIFIED	1b RESTRICTIVE MARKINGS:
2a SECURITY CLASSIFICATION AUTHORITY:	3 DISTRIBUTION/AVAILABILITY OF REPORT: Approved for public release; distribution unlimited
2b DECLASSIFICATION/DOWNGRADING SCHEDULE:	
4 PERFORMING ORGANIZATION REPORT NUMBER(S): NSMRL Report # 1144	5 MONITORING ORGANIZATION REPORT NUMBER(S):
6a NAME OF PERFORMING ORGANIZATION: Naval Submarine Medical Research Laboratory; 6b OFFICE SYMBOL (If applicable):	7a NAME OF MONITORING ORGANIZATION: Naval Medical Research & Development Command
6c ADDRESS (City, State, and ZIP Code): Naval Submarine Base New London Groton, CT 06349-5900	7b ADDRESS (City, State, and ZIP Code): NMC NCR, Bethesda, MD 20814-5044
8a NAME OF FUNDING/SPONSORING ORGANIZATION: Same as 7a; 8b OFFICE SYMBOL (If applicable):	9 PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER:
8c ADDRESS (City, State, and ZIP Code): Same as 7b	10 SOURCE OF FUNDING NUMBERS: PROGRAM ELEMENT NO 62233N; PROJECT NO MM33C30; TASK NO 002; WORK UNIT ACCESSION NO 5004

11 TITLE (Include Security Classification): (U) MEDIC - CHEST PAIN - A Decision Support Program for the Management of Acute Chest Pain - USER'S MANUAL

12 PERSONAL AUTHOR(S): LT Barclay C. Caras, MC, USNR

13a TYPE OF REPORT	13b TIME COVERED	14 DATE OF REPORT (Year, Month, Day)	15 PAGE COUNT
Interim	FROM 10/88 TO 9/89	1989 October 05	88

16 SUPPLEMENTARY NOTATION:

17 COSATI CODES			18 SUBJECT TERMS (Continue on reverse if necessary and identify by block number)
FIELD	GROUP	SUB-GROUP	Computer assisted; Myocardial infarction; Angina; Chest infection; non-specific chest pain; Diagnoses

19 ABSTRACT (Continue on reverse if necessary and identify by block number)

At sea, the Independent Duty Corpsman (8402) is responsible for the diagnosis and management of illnesses which arise. He must decide whether to treat the patient onboard the ship, or, if necessary, make recommendations regarding the evacuation of the patient. The corpsman's laboratory facilities are limited and, often, he is unable to communicate with shore-based facilities.

A computer based medical support system has been developed at the Naval Submarine Medical Research Laboratory (NSMRL), Groton, CT, to assist the corpsman in the diagnosis, triage, and management of patients who present with acute illnesses at sea. When completed, the system will consist of programs for acute abdominal pain, acute chest pain, dental complaints, psychiatric disorders, and trauma. The computer programs are designed for use on an IBM PC or an IBM PC compatible computer.

20 DISTRIBUTION/AVAILABILITY OF ABSTRACT	21 ABSTRACT SECURITY CLASSIFICATION
☐ UNCLASSIFIED/UNLIMITED ☐ SAME AS RPT ☐ DTIC USERS	UNCLASSIFIED
22a NAME OF RESPONSIBLE INDIVIDUAL: Susan D. Monty, Publications Office	22b TELEPHONE (Include Area Code): (203) 449-3967; 22c OFFICE SYMBOL: 421

DD Form 1473, JUN 86 — Previous editions are obsolete — S/N 0102-LF-014-6603

19. Cont'd.

The computer based chest pain program is intended for use between the ages of 17 and 79, and provides medical support for four causes of acute chest pain. They are myocardial infarction, angina, chest infection, and non-specific chest pain. The program consists of a diagnostic module, which provides diagnostic and treatment suggestions for each of the chest pain diseases, a training module, which tests the corpsman's accuracy in abstracting data from patient narratives, and a SF-600 generation module, which prints medical record entries based on patient data entered into the program.

This report is a manual designed to train the Independent Duty Corpsman in the use of the chest pain decision support program. It is written for the person with little or no prior experience with computers. The manual describes the hardware and software needed to run the computer program and discusses in detail each of the program modules, definition of terms, and treatment protocols. After reading the manual, the user should be skilled in the use of the program without the need for supplementary training.